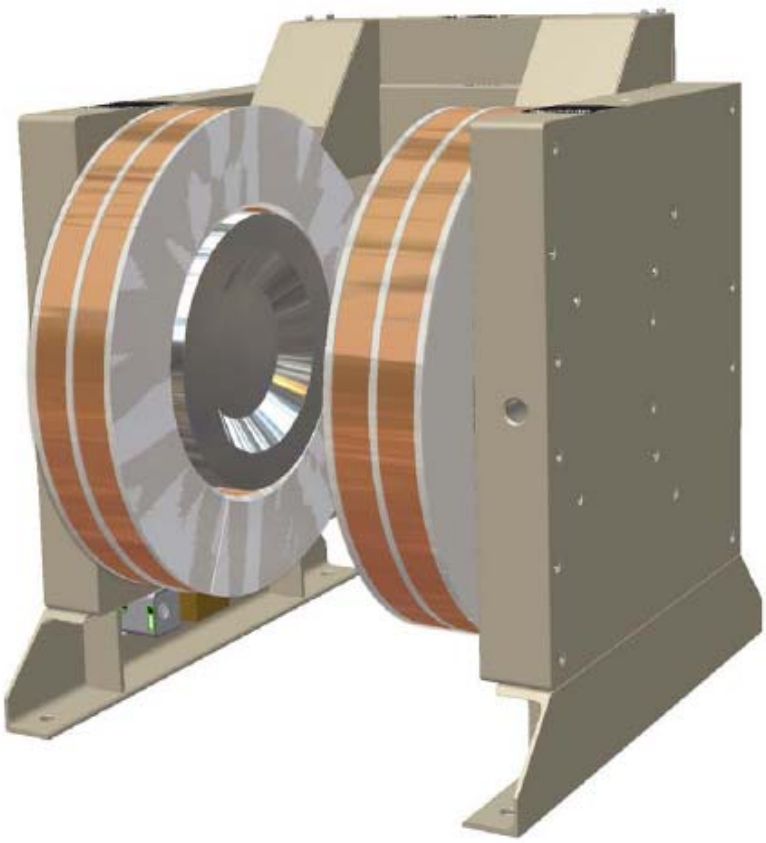
GMW

USER'S MANUAL

MODEL: 5503 Electromagnet



This User's manual is for SN01 and above.

PROPRIETARY
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GMW *955 Industrial Road, San Carlos, CA 94070 Tel: (650) 802-8292 Fax: (650) 802-8298*
Email: sales@gmw.com Web site: http://www.gmw.com

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Section 1
SPECIFICATIONS
Table 1. Model 5503 General Specifications

Pole Diameter	400 mm (15.75 inch)
Pole Gap	300 mm (11.81 inch)
Central Magnetic Field (Flux Density, B)	>0.3T at 140A (measured as 0.321T at 140A)
Field Uniformity (at 0.3T)	over 150mm diam x 130mm central cylinder with Cylinder axis along Y and perpendicular to B Angle $< \pm 1°$ $\Delta B/B < 0.3\%$
Coil Resistance (20^{o} C)	0.49 ohm (two coils connected in series)
Maximum Resistance (hot)**	0.59 ohm
Maximum Power [air cooled]	40A/24V (0.96kW)
Maximum Power [water cooled]	140A/82V (11.5kW)
Self Inductance, L	approx. 0.9H (measured as L=V/(dI/dt) and V~ 32V)
Water Cooling (18° C)	16 liters/m (4.2 US gpm) at 2.8 bar (41 psid)
Overtemperature Interlock	Elmwood 3450G thermal sensor part number 3450G 611-1 L50C 89/16 mounted on each coil and wired in series. Contact rating 120Vac,0.5A. Closed below 50^{o} C.
Water Flow Interlock	Johnson Controls flow switch part number F61KD mounted on outlet side of water circuit. Contact rating 120Vac/16A, 240Vac/8A non-inductive Set to close at a flow of more than 14 liter/min (3.7 US gpm)
Dimensions	Drawing 11907-0076-0 [2 sheets] 790mm W x 710 mm D x 815 mm H (31.1 inch W x 28.0 Inch D x 32.1 inch H)
Weight	1790 kg (3956 lb)

****CAUTION - The value of maximum coil resistance given should not be exceeded. At this resistance the coils are at maximum safe temperature for continuous operation.**

Section 1
SPECIFICATIONS
Table 2. Model 5503 Electrical and Water Connections

DC Current (Refer to Drawing 11907-0076-Sheet 2)**
Left Hand terminal Positive
Right hand terminal Negative

Ground
An M6 screw is provided alongside the dc current connections to enable the magnet frame to be grounded according to local safety regulations. It is normally appropriate to connect the magnet frame to the power supply ground.

Interlocks (Refer to Drawing 11907-0076-Sheet 1)

1	Water flow	Normally open. Closed when flow over 14/min (3.7 US gpm)
2	Water flow	
3	Overtemperature	Normally closed. Open when coil temperature exceeds 50^{o}C.
4	Overtemperature	
5	No connection	
6	No connection	
7	No connection	
8	Control ground	

Water (Refer to Drawing 11907-0076-Sheet 2)
outlet 3/8 inch NPT
inlet 3/8 inch NTP
(mating couplings for 1/2 inch hose provided)

****CAUTION** - Ensure that the high current connections are tight. Loose connections may lead to oxidation and overheating. The field stability may be degraded and the current terminations damaged.

Section 2

WARNINGS

REFER TO WARNINGS BELOW BEFORE OPERATING ELECTROMAGNET

1 Personnel Safety

The Electromagnet is operated at high current and high voltage. Do not remove protective covers or leave cable terminations exposed. Do not operate the electromagnet if covers or cables are damaged.

In operation, the magnet fringing field can be in excess of 0.5mT (5G). See Test Data, Magnetic Field Fringe Plots in Section 9 for fringe field measurements. This field level can cause malfunctioning of heart pacemakers and other medical implants. We recommend that warning signs be placed outside the 0.5mT (5G) contour. Entry to this region should be restricted to qualified personnel.

2 Ferromagnetic Objects

During operation the magnet exerts strong magnetic attraction towards ferromagnetic objects in the near vicinity of its pole gap or coils. Loose objects can be accelerated to sufficient velocity to cause severe personnel injury or damage to the coils or precision pole faces if struck. Keep ferromagnetic objects outside of the 0.5mT (5G) field region.

3 Arcing

This magnet stores considerable energy in its field during operation. Do not disconnect any current lead while under load or the magnetic field energy will be discharged across the interruption causing hazardous arcing.

4 Coil Hot Resistance

Do not exceed the maximum coil hot resistance of 0.59 ohm given in the specifications or coil overheating and possible damage may occur. The Coil resistance is readily checked by measuring the power supply voltage and current with $R \sim V/I$ (which ignores the current lead resistance).

5 Interlocks

These should ***always*** be connected if the magnet is operated unattended, to avoid the possibility of coil overheating caused by excessive power dissipation or inadequate cooling.

6 Watches, Credit Cards, and Magnetic Disks

Do not move magnetically sensitive items into the close vicinity of the magnet. Even some anti-magnetic watches can be damaged when placed in close proximity to the pole gap during operation. Credit cards, and magnetic disks are affected by magnetic fields as low as 0.5mT (5G). Depending on the previous operating field, the remnant field in the gap can be in excess of 1mT (10G) with the magnet power supply off or disconnected. Refer to the Excitation Curves in Section 8.

Section 3

INSTALLATION

Caution: This is a heavy system. The magnet mass is approximately 1800 kg (4000 lb) so lifting equipment of this capacity should be used to shift the magnet. Four lifting eyes threaded M33 are provided and they can be used in several holes. Be sure to ensure the eyes are screwed fully home before use. Flexible lifting slings of at least 4000kg (9,000 lb) lifting capacity are recommended to avoid failure of the slings and possible damage to the magnet. All movement, lifting and installation of the 5503 Electromagnet must be under the supervision of an experienced person to prevent the possibility of serious injury or damage to the Electromagnet and associated equipment.

Mounting Position

Horizontal and Vertical mounting kits are available. See Drawing 11907-0082-0 showing the magnet mounted horizontally on Horizontal Mounting Kit Drawing 11907-0081-0.

Alternatively, vertical mounting brackets can be used to position the field axis vertically.

In each case the magnet should be oriented with the water lines below the electrical connections to reduce the chance of water leakage shorting electrical connections.

Unpacking Instructions and Damage Inspection

To unpack the electromagnet please use the following procedure (Refer to Drawing 18907-0001-0).

1. First remove all of the "Hex Head Screws" located at the lower edge of all the side panels of the "Crate Top Cover".
2. Gently rock the "Crate Top Cover" to work it loose from the shipping crate base.
3. Use one person on each side of the shipping crate grip the side panels of the Crate Top Cover. Lift "Crate Top Cover" high enough to clear top of electromagnet, walk cover sideways to clear area and place on floor.
4. Inspect the magnet to ensure that no damage has occurred to the magnet in shipment. If damage is evident report the damage in detail to the shipper for claim and simultaneously notify GMW in case assessment of the damage must be made. If no damage is found proceed with magnet unpacking and installation.
5. Remove the M16 Hex Bolts that secure the magnet to the steel shipping angle brackets.
6. Remove the hex lag bolts that secure the steel "shipping angle brackets" to shipping crate base, and remove shipping angle brackets.
7. The magnet is now prepared for final installation, follow the appropriate procedure to install to vertical or horizontal mounting.

Horizontal Mounting

1. With suitable lifting equipment (e.g. 4000kg (9000 lb.) minimum safe lifting rating), lift magnet 50mm (2") clear of shipping crate base.
2. Slide shipping crate base clear.
3. Lower magnet to 50mm (2") above floor.
4. Move magnet to final location and secure in place.

Section 3

INSTALLATION

Electrical Circuit

Never connect or remove cables from the magnet with the power supply energized. The stored energy in the magnet can cause arcing resulting in severe injury or equipment damage.

The magnet has two coils which are connected in series (140A/82V). The power supply cables should be connected directly to the DC current terminals marked + and -. Recommended current cable is stranded copper of at least 50mm² cross section (2 AWG). Refer to Drawing 13907-0006-0 for details.

Because the magnet stores a significant amount of energy in its magnetic field, special care should be taken to insure that the current terminations are secure and cannot work loose in operation. Local heating at the terminations can cause rapid oxidation leading to a high contact resistance and high power dissipation at the terminals. If left unattended this can cause enough local heating to damage the terminals and the coils.

To protect the power supply from being damaged by a reverse current from the magnet in the event of an ac power failure, a reverse biased diode must be connected across the power supply output terminals as shown in Drawing 13907-0006-0. The anode of the diode (or positive terminal) is connected to the negative output of the power supply.

Interlocks

Six thermal sensors Elmwood 3450G Part Number 3450G611-1 L50C 89/16 are wired in series and terminated in positions 3 and 4 on the Interlock Terminal block, item 55 on Drawing 11907-0076-0 Sheet 2. They are normally closed, opening when the coil central cooling plate temperature exceeds $50^{O}C$ $+/3^{O}C$. The flow switch is connected to terminals 1 and 2. The contacts are normally open, closing when the water flow exceeds approximately 15 liter/min.

Note: If the power supply does not provide for a separate water flow interlock, connect water flow and temperature interlocks in series on the magnet. See Drawing 13907-0006-0 for details.

Section 3

INSTALLATION

Cooling

The Model 5503 can be operated to an average coil temperature of 70^{O}C. Assuming an ambient laboratory temperature of 20^{O}C and a temperature coefficient of resistivity of 0.004/^{O}C, the hot resistance of the coil should not exceed 20% more than the ambient temperature "cold" resistance.
The coil thermal sensor will open when the coil cooling plate temperature exceeds approximately 50^{O}C . Clean, cool (12^{O}C - 20^{O}C) water at 16 liter/min and 2.8 bar (41 psid) should be used to cool the magnet. The cooling tubes are not electrically connected to the coils so no electrochemical corrosion will occur. A 50 micron filter should be placed before the input to the magnet to avoid unreliable operation of the flow switch caused by particulates.

To isolate the Electromagnet for service and to enable the water flow to be adjusted slowly to avoid damage to the flow switch, valves should be installed as show in Drawing 11907-0084-0.

For continuous operation of the magnet it may be appropriate to use a recirculating chiller to reduce water and drainage costs. The chiller capacity will depend on whether cooling is required for the magnet alone or magnet and power supply. For the Model 5503 Electromagnet alone a suitable chiller is the Bay Voltex MC300-A1-E1-H2-J2. Use distilled or deionized water with a biocide to prevent bacterial growth and corrosion. Do not use corrosion inhibitors in high quality electrical systems since the water conductivity is increased which can result in increased leakage currents and electrochemical corrosion.

At currents of below 40A, the Model 5503 can be operated safely without water cooling. However the coil temperature will vary with the power dissipation. This results in dimensional and permeability changes of the magnet yoke. Air cooling is not suitable when very high field stability is required.

Freon, oil, ethylene glycol or other cooling mediums can be used. The flow required will be approximately inversely proportional to their specific heats. An experimental determination of the flow and pressure required will be necessary.

Avoid cooling the magnet below the dew point of the ambient air. Condensation may cause electrical shorts and corrosion.

During operation the resistance can be checked using a voltmeter across each coil. The voltage will rise to a constant value once thermal equilibrium has been reached. If it is desired to save water, the flow can be reduced until the hot resistance is approached. NOTE: This adjustment must be made slowly enough to allow for the thermal inertia of the coils.

Section 4

OPERATION

Recommended Power Supply

For semiconductor annealing applications to magnetic fields of 0.3T the power supply used with the Model 5503 should have a dc output current rating of 150A and an output voltage to 100V with load capability of 0.5 to 0.6 ohm at up to 1H without oscillation or instability. To provide a stable magnetic field the power supply should be operable in "current mode" to deliver a constant set current with overall stability of approximately 1% of full-scale current. It is essential that the power supply current can be set to zero via the opening of a normally closed interlock switch string to prevent damage to the Model 5503 or power supply in the event of water flow failure or coil overtemperature.

A suitable power supply is the Sorensen SGA Series. The Operations Manual for the SGA series is available from:

http://www.elgar.com/products/SG/downloads/SGA_Operation_Manual_M550129-01_Rev_G.pdf

Section 1.2 "Specifications" is extracted and follows. Electrical connections for the Model 5503 with the Sorensen SGA series are given in Drawings 11907-0083-0 and 13907-0006-0.

SECTION 1
OVERVIEW

1.1 GENERAL DESCRIPTION

The Sorensen SGA Series power supplies are general–purpose power supplies designed specifically for laboratory test and systems applications requiring variable DC sources with good ripple and regulation characteristics. These power supplies are constant current/constant voltage supplies with an automatic crossover feature.

A variety of user interfaces are available, ranging from manual front–panel control and standard non–isolated remote analog control, to optional GPIB, Ethernet or isolated remote analog control.

1.2 SPECIFICATIONS

The following subsections provide environmental, electrical, and physical characteristics for the SGA Series power supplies.

Note: Specifications are subject to change without notice.

Note: The SGA Series power supplies are intended for indoor use only.

1.2.1 ENVIRONMENTAL CHARACTERISTICS

Parameter	Specification
Temperature Coefficient	0.02%/°C of maximum output voltage rating for voltage set point. 0.03%/°C of maximum output current rating for current set point.
Ambient Temperature	
Operating	0 to 50°C
Storage	-25° to 65°C
Cooling	Internal fans. Units may be stacked without clearance.
Humidity	0 to 90% (non-condensing) at 40°C, derate to 50% (non-condensing) at 25°C
Altitude	Operating full power available up to 5,000 feet (1,524m), derate 10% of full power for every 1,000 feet higher non-operating to 40,000 feet (12,192m)
Agency Approvals	CE Mark to the Low Voltage and EMC directives NRTL approved to UL 1012, UL 61010, EN 61010, IEC 61010

1.2.2 ELECTRICAL CHARACTERISTICS

Parameter	Specification
Input Power	
Voltage (Standard)	208/220 VAC±10% (tested to 187-242 VAC)
Voltage (Options)	380/400 VAC±10% (tested to 342-440 VAC) 440/480 VAC±10% (tested to 396-528 VAC)
Frequency	47 to 63 Hz
Phases	3–phase, 3–wire plus ground. Not phase rotation sensitive. Neutral not used.
Front Panel Meter Accuracy	
Voltage	±0.5% of full-scale + 1 digit
Current	±0.5% of full-scale + 1 digit
Load Regulation (Specified at no load to full load, nominal AC input)	
Voltage	0.02% of maximum output voltage
Current	0.1% of maximum output current
Line Regulation (Specified ±10% of nominal AC input, constant load)	
Voltage	0.01% of maximum output voltage
Current	0.05% of maximum output current
Transient Response	A 50% step load will recover to within 0.75% of original value within 1 ms.

Parameter	Specification
Down Programming	With no load the output will program from 100 to 10% in less than 1.5 seconds
Stability	±0.05% of set point after 8–hr. warm-up at fixed line, load, and temperature using remote sense
Remote Control/Monitor	On/Off control via contact closure, 6-120 VDC or 12-240 VAC, and TTL or CMOS switch, output voltage and current monitor, OVP limit set, summary fault status
Power Factor	>0.9 typical for 208/220VAC input >0.78 typical for 380/400VAC input >0.7 typical for 440/480VAC input
Efficiency	87% typical at full load, nominal line
Analog Remote Programming	
Accuracy	
Constant Voltage	±0.25% of full-scale output (Vp5 input)
Constant Current	±0.8% of full-scale output
Overvoltage Protection (OVP)	±1% of full-scale output
Resistive	
Constant Voltage (0-100%)	0–5 kΩ
Constant Current (0-100%)	0–5 kΩ
Voltage	
Constant Voltage (0-100%)	0–5 VDC or 0–10 VDC
Constant Current (0-100%)	0–5 VDC or 0–10 VDC
Overvoltage Protection (OVP) (0-110%)	0–5.5 VDC
Remote Sensing	Terminals are provided to sense output voltage at point of load. Maximum line drop 5% of rated voltage per line for 40-100V models, 2% of rated voltage per line for models 160V and greater. (Greater line drop is allowed, but output regulation specifications no longer apply).
ISOLATED ANALOG CONTROL (OPTION)	
Input to Output Isolation	500 V Compliant with maximum terminal float voltage. Recommended operation under SELV normal conditions.

1.2.3 SGA SERIES VOLTAGE AND CURRENT SPECIFICATIONS

	Amperage						Ripple* RMS	Noise* P–P
Voltage	**5 kW**	**10 kW**	**15 kW**	**20 kW**	**25 kW**	**30 kW**		
0-40V	0-125A	0-250A	0-375A	0-500A†	0-625A†	0-750†	20 mV	75 mV
0-60V	0-83A	0-167A	0-250A	0-333A	0-417A	0-500A	20 mV	75 mV
0-80V	0-63A	0-125A	0-188A	0-250A	0-313A	0-375A	20 mV	100 mV
0-100V	0-50A	0-100A	0-150A	0-200A	0-250A	0-300A	20 mV	100 mV
0-160V	0-31A	0-63A	0-94A	0-125A	0-156A	0-188A	25 mV	150 mV
0-200V	0-25A	0-50A	0-75A	0-100A	0-125A	0-150A	25 mV	175 mV
0-250V	0-20A	0-40A	0-60A	0-80A	0-100A	0-120A	30 mV	200 mV
0-330V	0-15A	0-30A	0-45A	0-61A	0-76A	0-91A	30 mV	200 mV
0-400V	0-12A	0-25A	0-38A	0-50A	0-63A	0-75A	30 mV	300 mV
0-600V	0-8A	0-17A	0-25A	0-33A	0-42A	0-50A	40 mV	350 mV

***** Ripple and noise specified at full load, nominal AC input

† Power level not available in 6U chassis. In 3U chassis, these power levels can be achieved by paralleling with 5 kW, 10 kW, and 15 kW. Note that paralleling will increase Ripple and Noise.

1.2.4 PHYSICAL CHARACTERISTICS

Dimension	3U Models	6U Models
Width	19.00 in (48.3 cm)	19.00 in (48.3 cm)
Depth	25.12 in (63.8 cm) 40V models: 25.46 in (64.7 cm)	25.12 in (63.8 cm)
Height	5.25 in (13.3 cm)	10.5 in (26.7 cm)
Weight	(5kW) ≈ 40 lbs (18 kg) (10kW) ≈ 60 lbs (27 kg) (15kW) ≈ 80 lbs (36 kg)	(20 KW) ≈ 120 lbs (54 kg) (25 kW) ≈ 140 lbs (64 kg) (30kW) ≈ 160 lbs (73 kg)

Section 4

OPERATION

Initial Operation

The magnet operates as a conventional electromagnet.

1. Adjust the cooling water flow to about 16 liters/min (4.2 US gpm). Open the water valve slowly to avoid damage to the water flow switch. For operation at less than maximum power the water flow may be correspondingly reduced.

2. The power supply should be set to run in “current mode” not “voltage mode”, for initial operation. Turn on the power supply and slowly increase the current until the desired field is reached. Check the magnetic field value achieved correlates with that given for the excitation curve, see the Field vs. Current graph in Section 8.

Once the System operations has been checked to be satisfactory, the power supply voltage control should be set to maximum to allow for the increase in voltage required to maintain constant maximum current as the Coil resistance increases with temperature. See note 2 below.

Calibration

The excitation curves in Section 8 may be used to estimate the field in the air gap to within four or five percent. More accurate field determination may be obtained by deriving experimentally a calibration curve for the 5503 electromagnet. Magnetic hysteresis in the yoke and poles can cause an error of 1mT (10G).

An absolute calibration of Magnetic Field v Electric current transfer coefficient has been made at the full-scale current of approximately 140A. For details refer to Section 9, Test Data, Magnetic Field Stability, Calculation of Field v. Current.

Note:

1. The magnetic field is defined only at the point it is measured. It will generally be different at a different point in the pole gap. For example, the induction curves refer to the field on the pole axis and at the center of the pole gap (median plane).

2. The field is a function of the current in the magnet coils. Voltage across the coils is not a good measure of field since the electrical resistance of the coils depends on the temperature, increasing about 0.4%/°C in coil temperature. From cold to hot operation at constant current the power supply output voltage may increase by up to about 20%.

Section 4

OPERATION

Field Control Operation

The necessity to use calibration curves can be avoided by using a field controller to sense the magnetic field and provide a corresponding power supply control signal through the power supply programming inputs. Contact GMW for suitable instrumentation.

Section 5

MAINTENANCE

Take care not to damage the relatively soft pole surface since this may degrade the magnetic field uniformity in the gap. With a large Pole Gap magnet like the Model 5503, minor mechanical change to the Pole surface is not critical and will not measurably change the magnetic field uniformity or angle distribution.

The surface treatments used provide good corrosion protection but in order to maintain the inherent mechanical precision of the magnet, heavy build-up of plating materials is deliberately avoided. The pole plating is electroless nickel approximately 0.01mm thick. As a result, high humidity or otherwise seriously corrosive atmospheres can cause corrosion. Apply an appropriate corrosion protection such as light machine oil like "3:1" about every 12 months, or if corrosion damage appears or if the magnet is stored for an extended period. Wipe off all excess oil.

Check the cooling water circuit to ensure the water is clean and free of debris and bacterial growth. Ensure the in-line water filter is clean. Replace the filter element if required.

Ensure that all electrical connections are clean and tight. Check that the insulation of all electrical cables is undamaged and repair or replace if necessary. All electrical termination covers must be in place and firmly secured.

Model 5503 Spare Components

The model 5503 requires no other regular maintenance or parts replacement. Components that may fail because of damage or many years of use are listed below.

Drawing	Item	Quantity	Part Number	Description
11907-0076-0	57	6	3450 G611.1L50C	Temperature Sensor. 50°C. Elmwood
11907-0076-0	72	1	F61KB-11C	Flow Switch. Johnson Controls

Section 6

STANDARD OPTIONS

Section 7

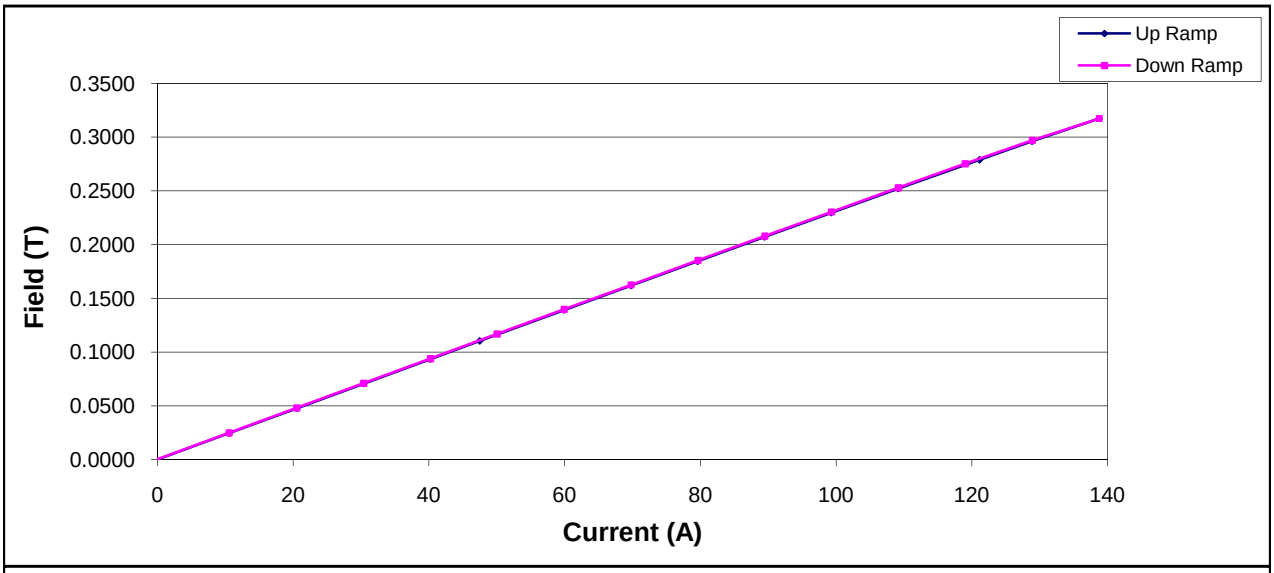
CUSTOM OPTIONS

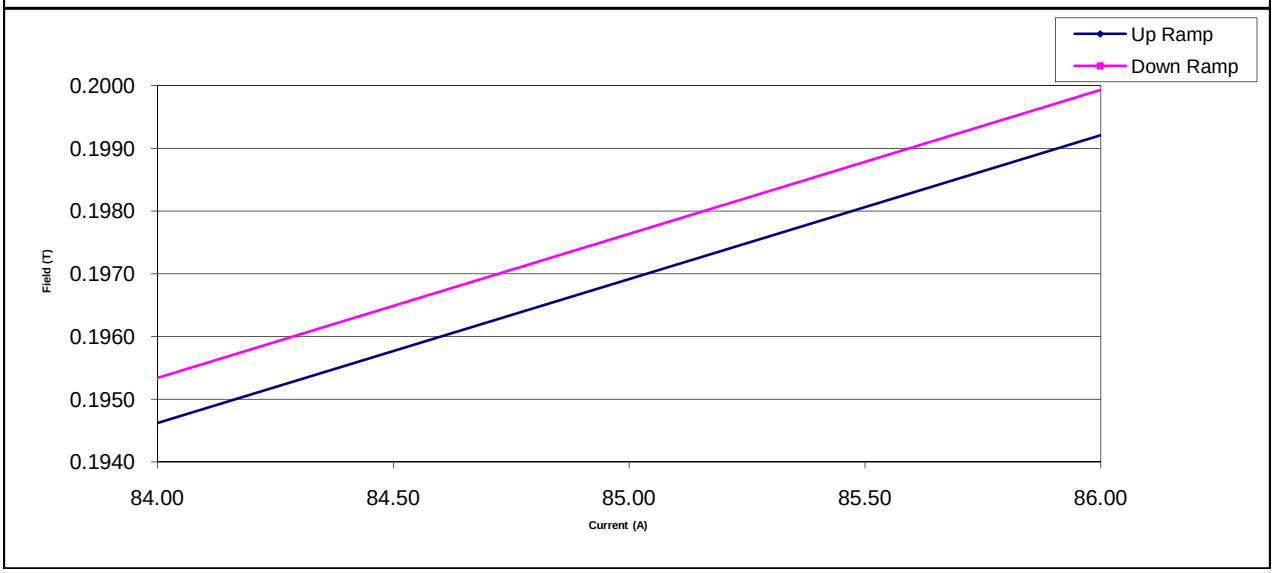
Section 8

EXCITATION CURVES

GMW Associates
Electromagnet Excitation Plot
Field Vs Current

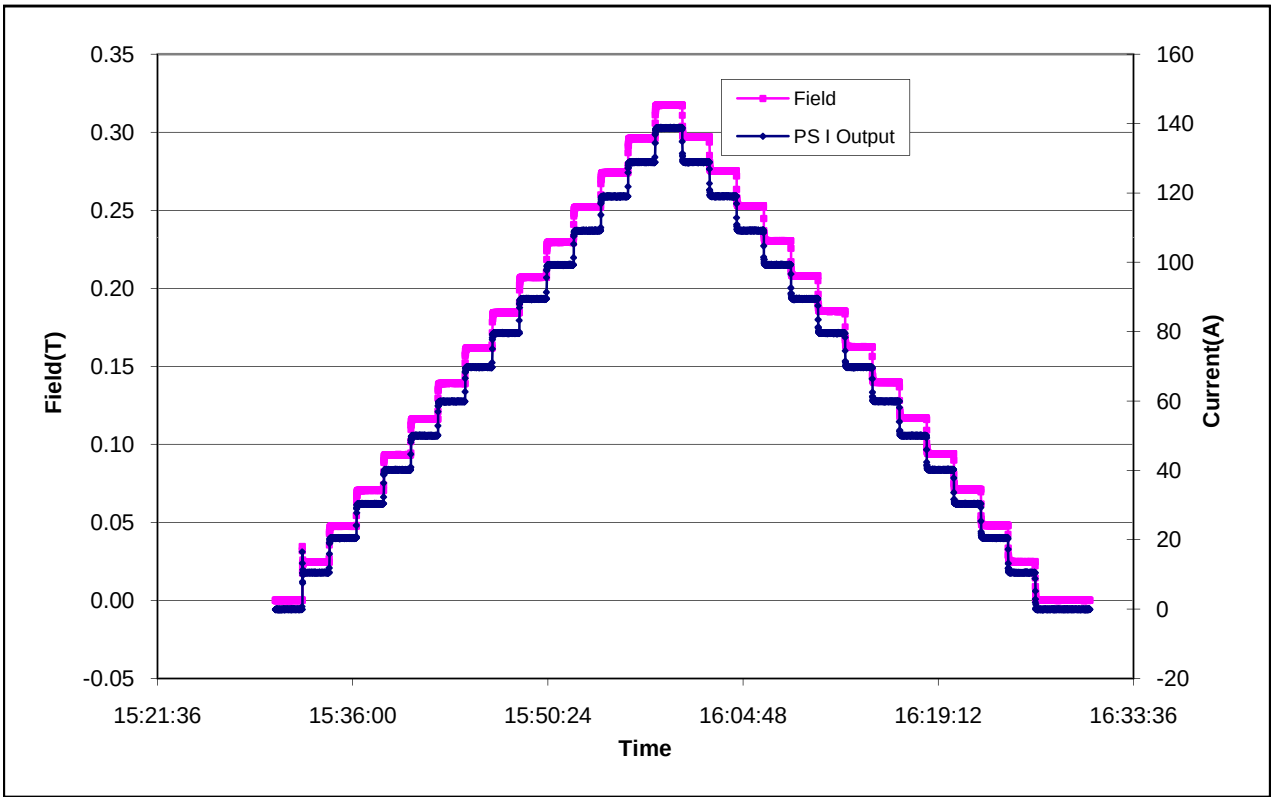
Model:	5503	Engr:	Y. Qin
Serial No:	1	Date:	7/6/2007
Contract No:		Page:	1 of 2
Power supply:	PowerTen P83C-100150, 100V/150A		
Power supply SN:	0250A00730		
Current Reading:	DF860R, 200A max, SN: 10043006		
Field Reading:	Senis 3-axis, 2T, 1%		
Note 1:	Read field and current using NI DAQPad6015		
Note 2:	Step current up then down, 10A step, 2 min each step		
Pole Gap(mm):	300		
Pole Face Radius(mm):	200		
Position(mm):	X=0, Y=0, Z=0		





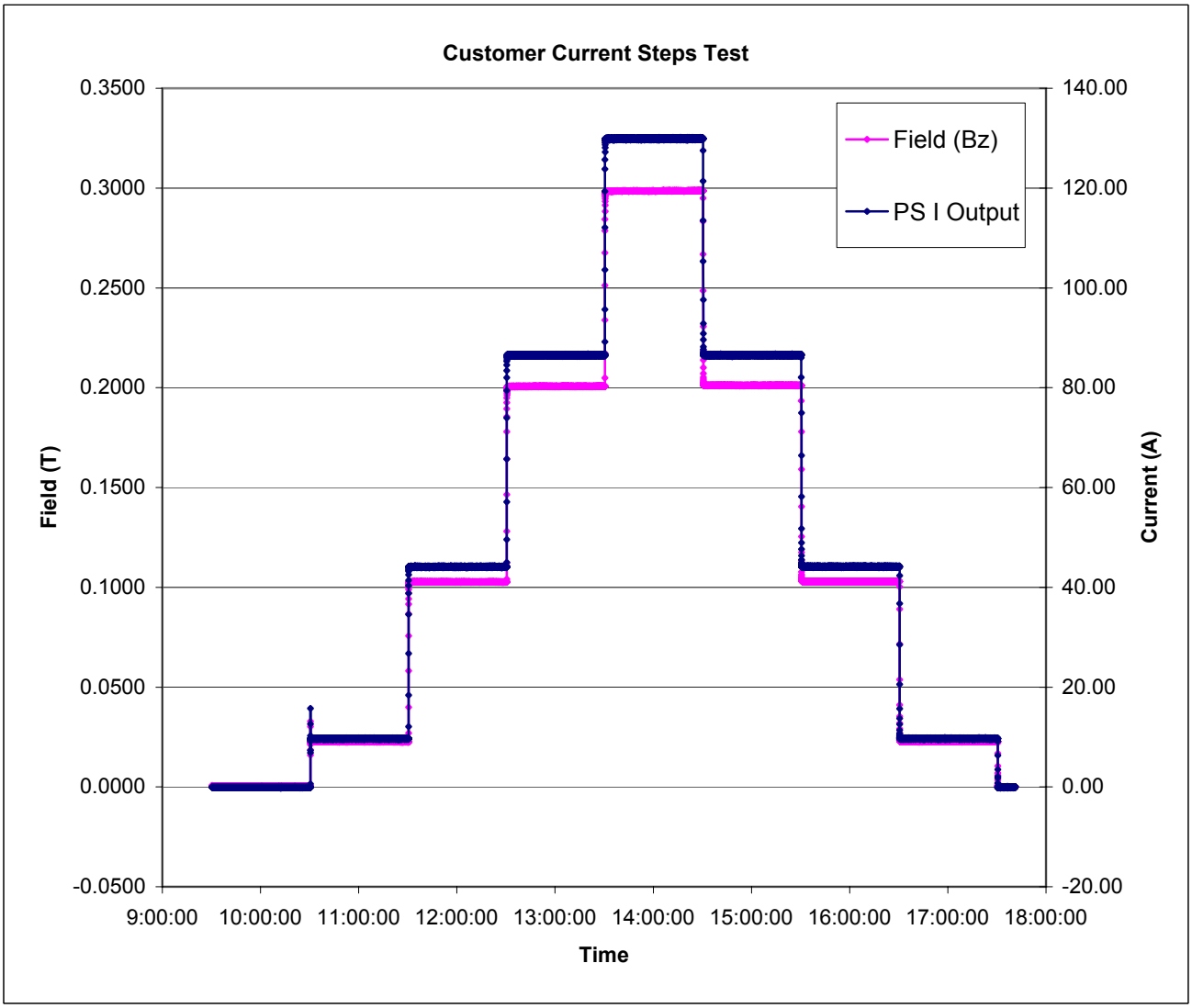
GMW Associates
Electromagnet Excitation Plot
Field Vs Current

Model:	5503	Engr:	Y. Qin
Serial No:	1	Date:	7/6/2007
Contract No:		Page:	2 of 2
Power supply:	PowerTen P83C-100150, 100V/150A		
Power supply SN:	0250A00730		
Current Reading:	DF860R, 200A max, SN: 10043006		
Field Reading:	Senis 3-axis, 2T, 1%		
Note 1:	Read field and current using NI DAQPad6015		
Note 2:	Step current up then down, 10A step, 2 min each step		
Pole Gap(mm):	300		
Pole Face Radius(mm):	200		
Position(mm):	X=0, Y=0, Z=0		



GMW Associates
Electromagnet Excitation Plot
Field Vs Time

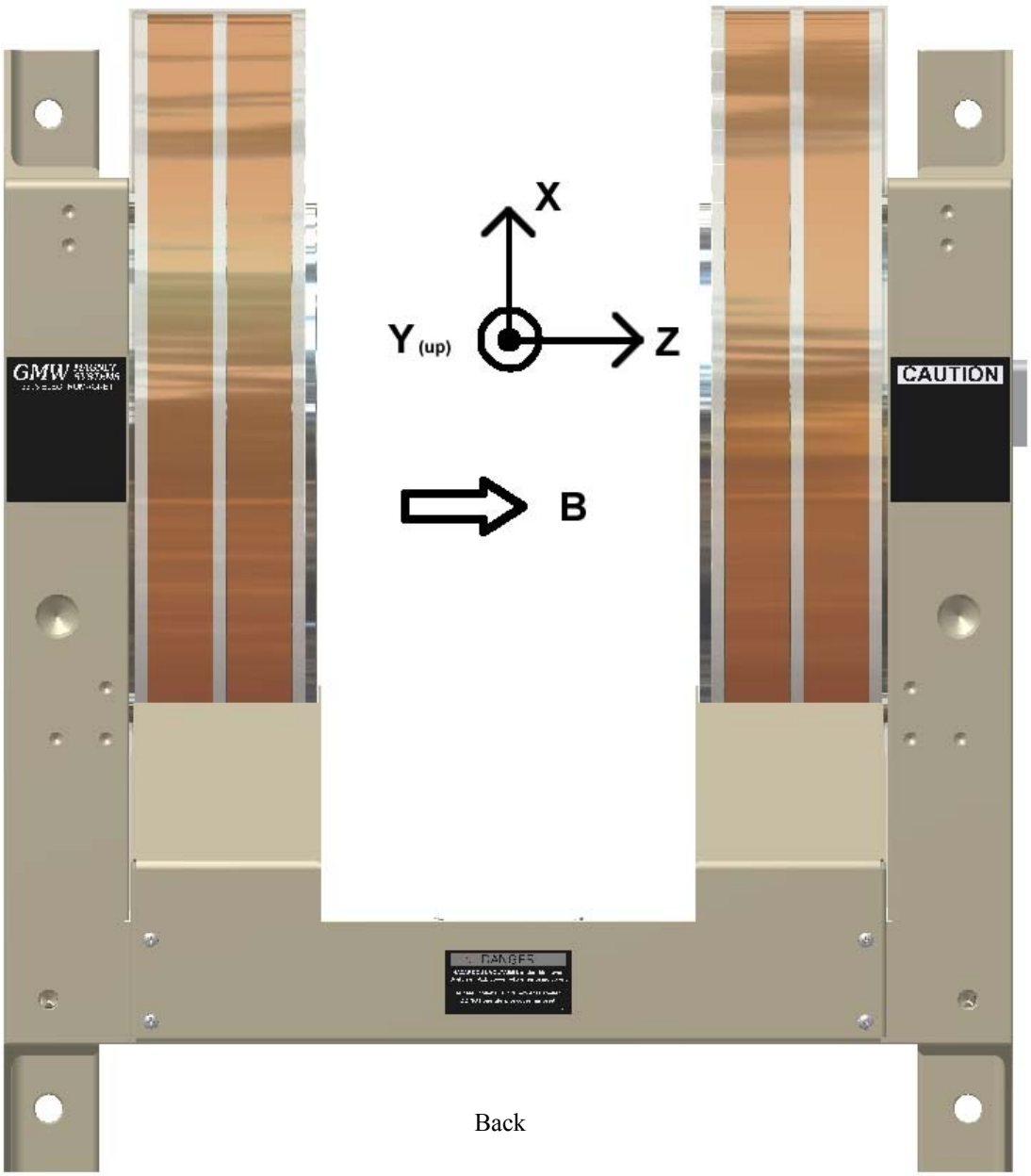
Model:	5503	Engr:	Y. Qin
Serial No:	1	Date:	7/16/2007
Contract No:		Page:	1 of 1
Power supply:	PowerTen P83C-100150, 100V/150A		
Power supply SN:	0250A00730		
Current Reading:	DF860R, 200A max, SN: 10043006		
Field Reading:	Senis 3-axis, 2T, 1% probe		
Note 1:	Read field and current using NI DAQPad6015		
Note 2:	Customer defined current steps, 1 hour for each current step		
Pole Gap:	300 mm		
Pole Face (Radius):	200 mm		



Section 9

TEST DATA

Front



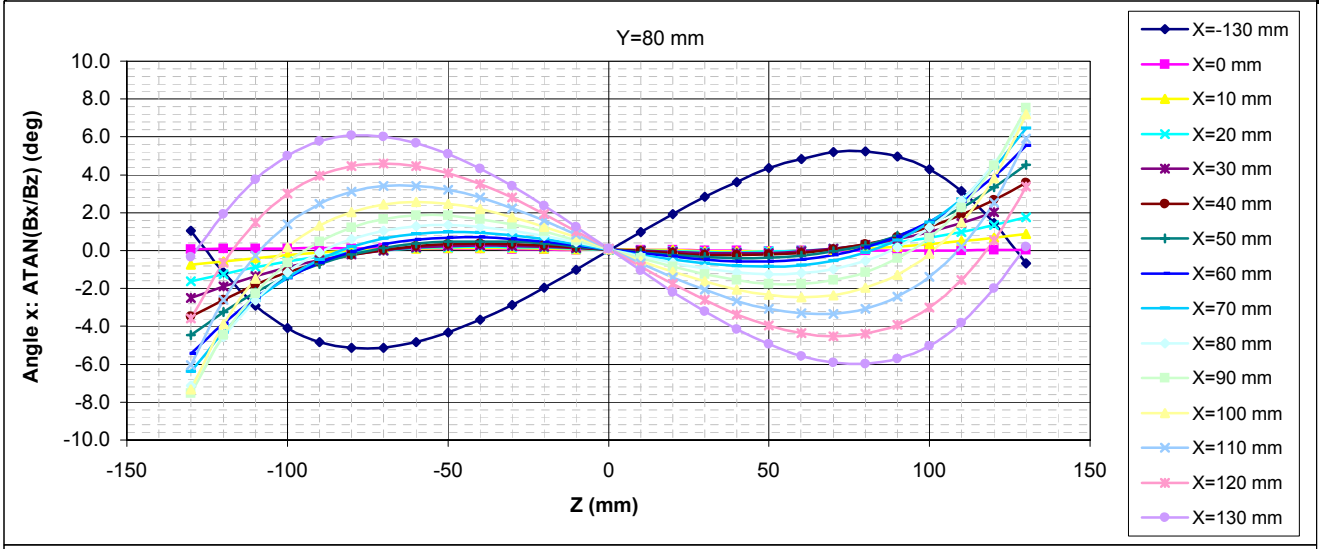
Back

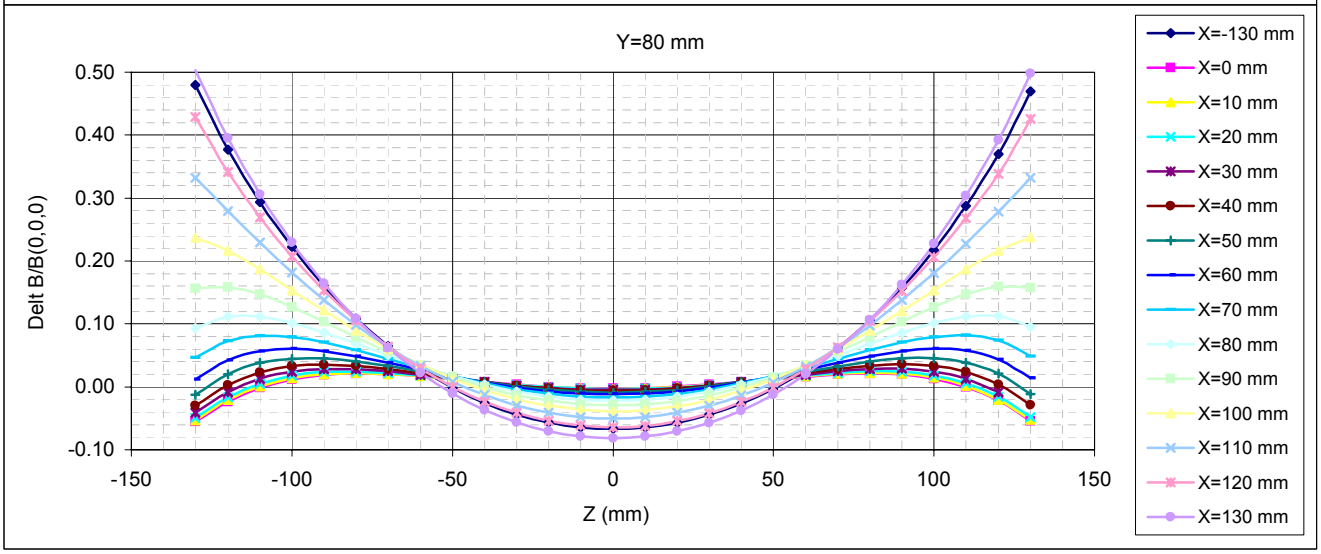
Model 5503 Electromagnet from top view. Showing B direction and mapping axes.

GMW Associates
Electromagnet Field Uniformity Plot

Model:	5503	Engr:	Y. Qin
Serial No:	1	Date:	7/16/2007
Contract No:		Page:	1 of 2

Power supply:	PowerTen P83C-100150, 100V/150A
Power supply SN:	0250A00730
Current Reading:	DF860R, 200A max, SN: 10043006
Field Reading:	Senis 3-axis, 2T, 1% probe, for noted data points
Note 1:	Read field and current using Agilent 34970A, SN:USA37035272
Note 2:	B=(Bx^2+Bz^2)^(1/2) Btotal=(Bx^2+By^2+Bz^2)^(1/2)
Pole Gap:	300 mm
Pole Face (Radius):	200 mm
Position:	Y=80mm

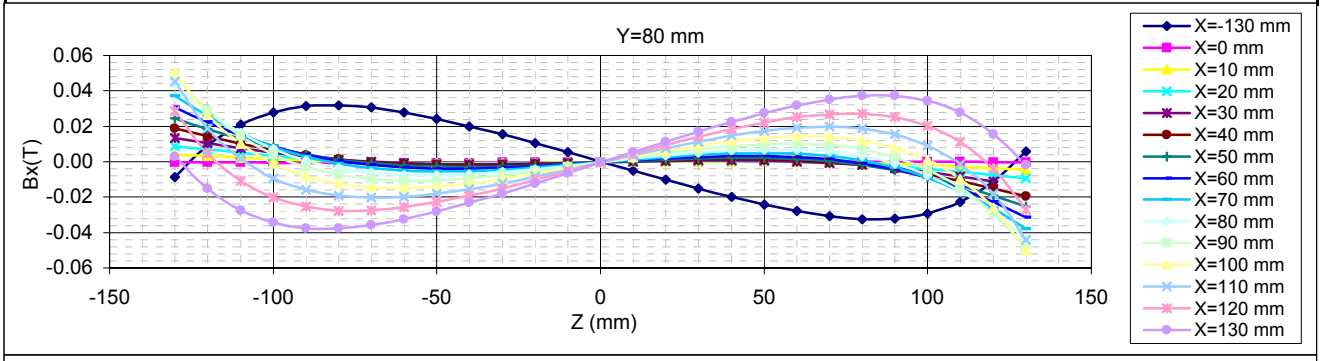


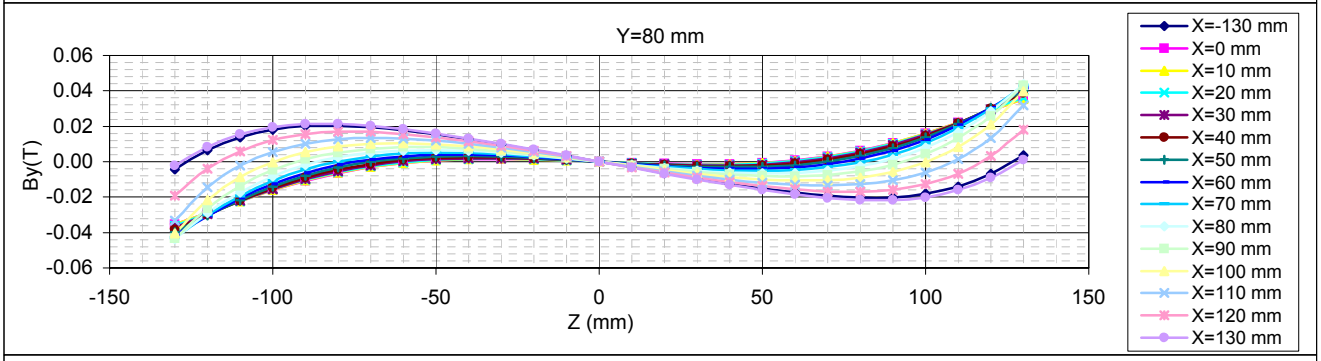


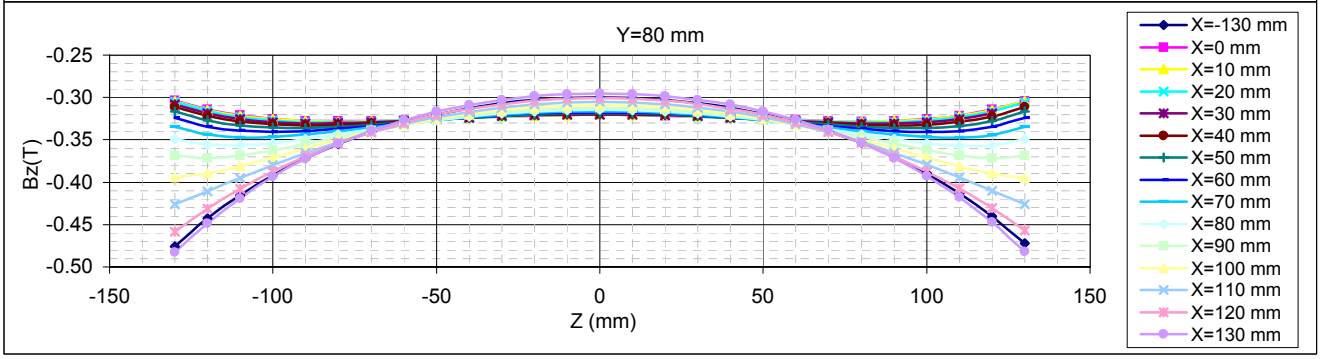
GMW Associates
Electromagnet Field Uniformity Plot

Model:	5503	Engr:	Y. Qin
Serial No:	1	Date:	7/16/2007
Contract No:		Page:	2 of 2

Power supply:	PowerTen P83C-100150, 100V/150A
Power supply SN:	0250A00730
Current Reading:	DF860R, 200A max, SN: 10043006
Field Reading:	Senis 3-axis, 2T, 1% probe, for noted data points
Note 1:	Read field and current using Agilent 34970A, SN:USA37035272
Note 2:	B=(Bx^2+Bz^2)^(1/2) Btotal=(Bx^2+By^2+Bz^2)^(1/2)
Pole Gap:	300 mm
Pole Face (Radius):	200 mm
Position:	Y=80mm



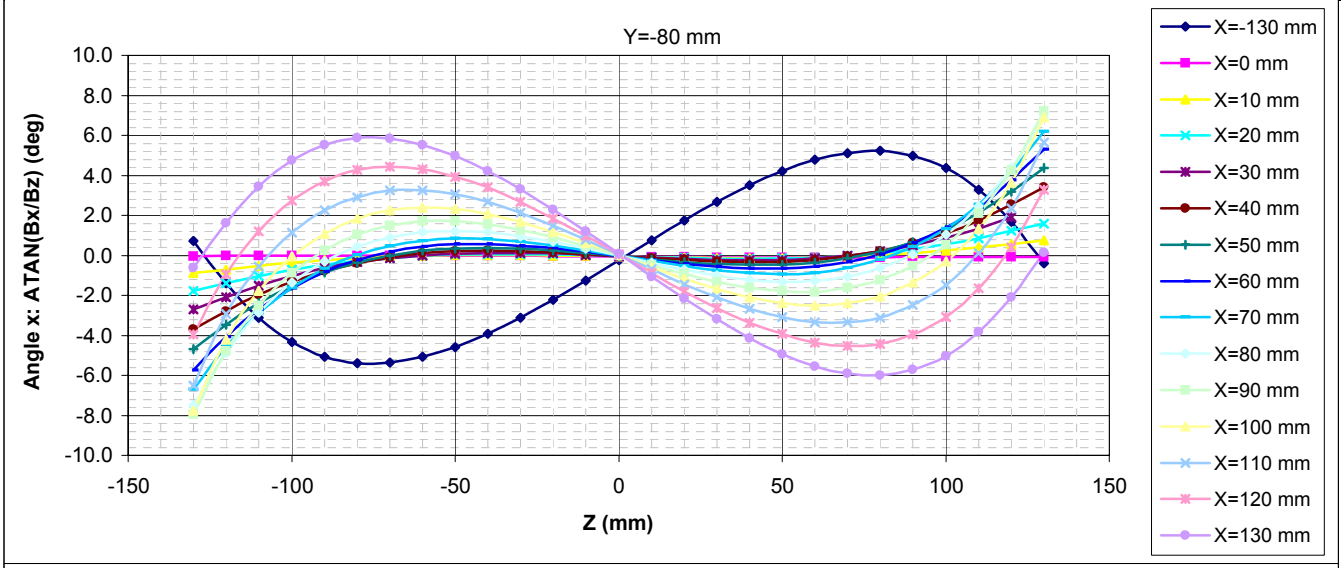


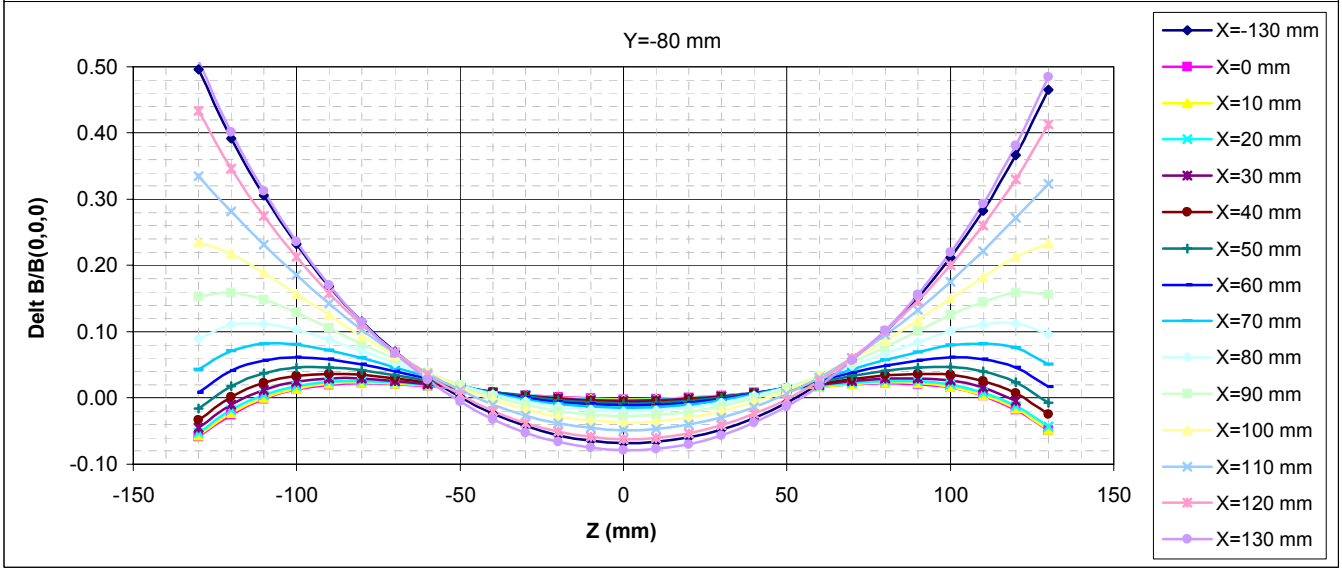


GMW Associates
Electromagnet Field Uniformity Plot

Model:	5503	Engr:	Y. Qin
Serial No:	1	Date:	7/16/2007
Contract No:		Page:	1 of 2

Power supply:	PowerTen P83C-100150, 100V/150A
Power supply SN:	0250A00730
Current Reading:	DF860R, 200A max, SN: 10043006
Field Reading:	Senis 3-axis, 2T, 1% probe, for noted data points
Note 1:	Read field and current using Agilent 34970A, SN:USA37035272
Note 2:	B=(Bx^2+Bz^2)^(1/2) Btotal=(Bx^2+By^2+Bz^2)^(1/2)
Pole Gap:	300 mm
Pole Face (Radius):	200 mm
Position:	Y=-80mm

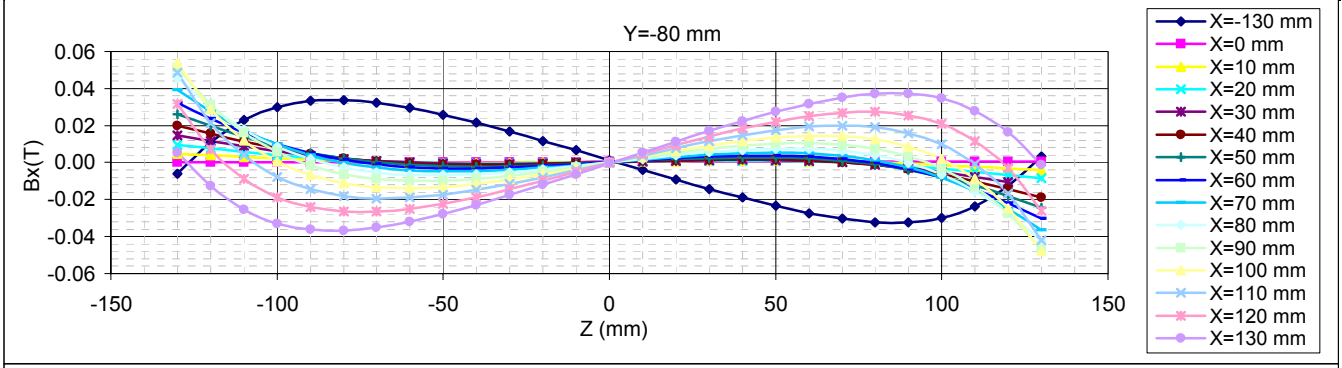


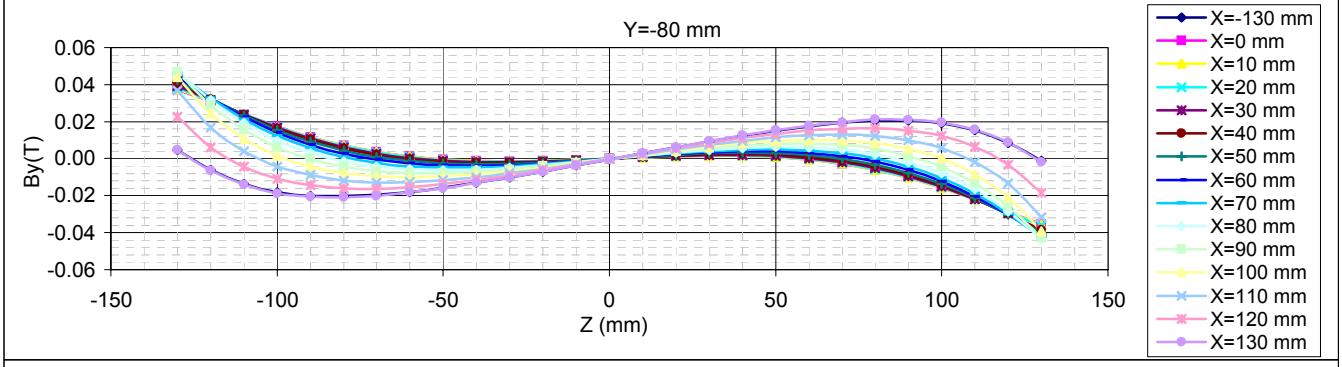


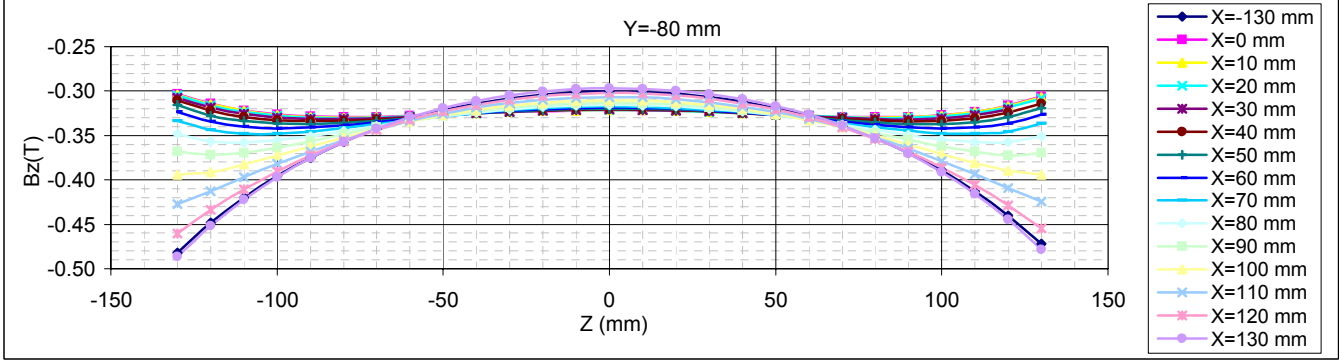
GMW Associates
Electromagnet Field Uniformity Plot

Model:	5503	Engr:	Y. Qin
Serial No:	1	Date:	7/16/2007
Contract No:		Page:	2 of 2

Power supply:	PowerTen P83C-100150, 100V/150A
Power supply SN:	0250A00730
Current Reading:	DF860R, 200A max, SN: 10043006
Field Reading:	Senis 3-axis, 2T, 1% probe, for noted data points
Note 1:	Read field and current using Agilent 34970A, SN:USA37035272
Note 2:	B=(Bx^2+Bz^2)^(1/2) Btotal=(Bx^2+By^2+Bz^2)^(1/2)
Pole Gap:	300 mm
Pole Face (Radius):	200 mm
Position:	Y=-80mm



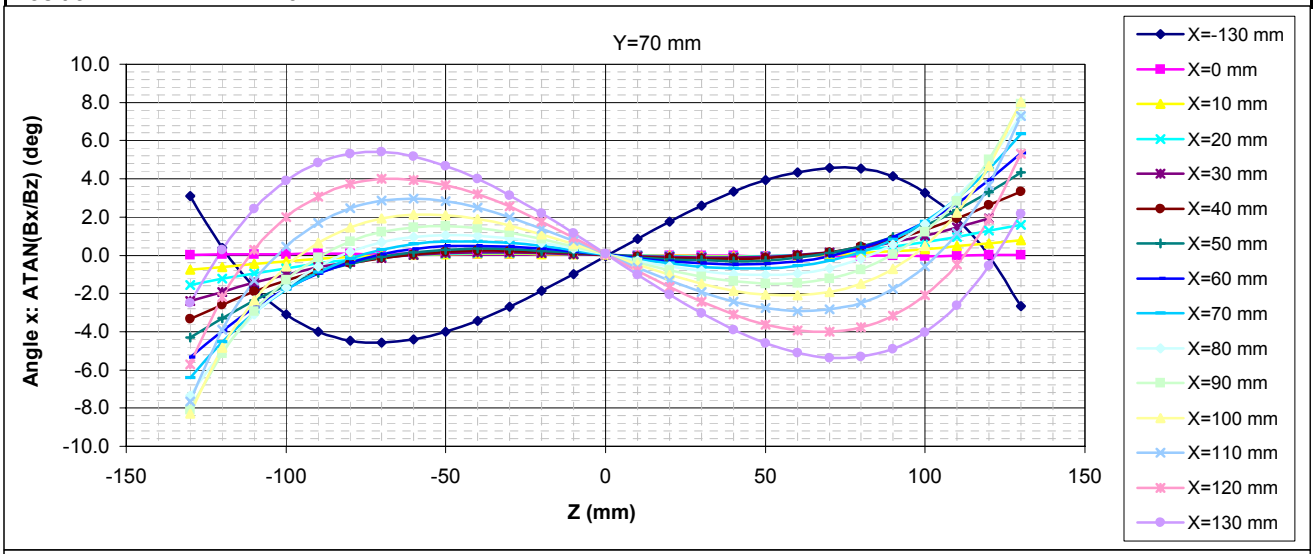


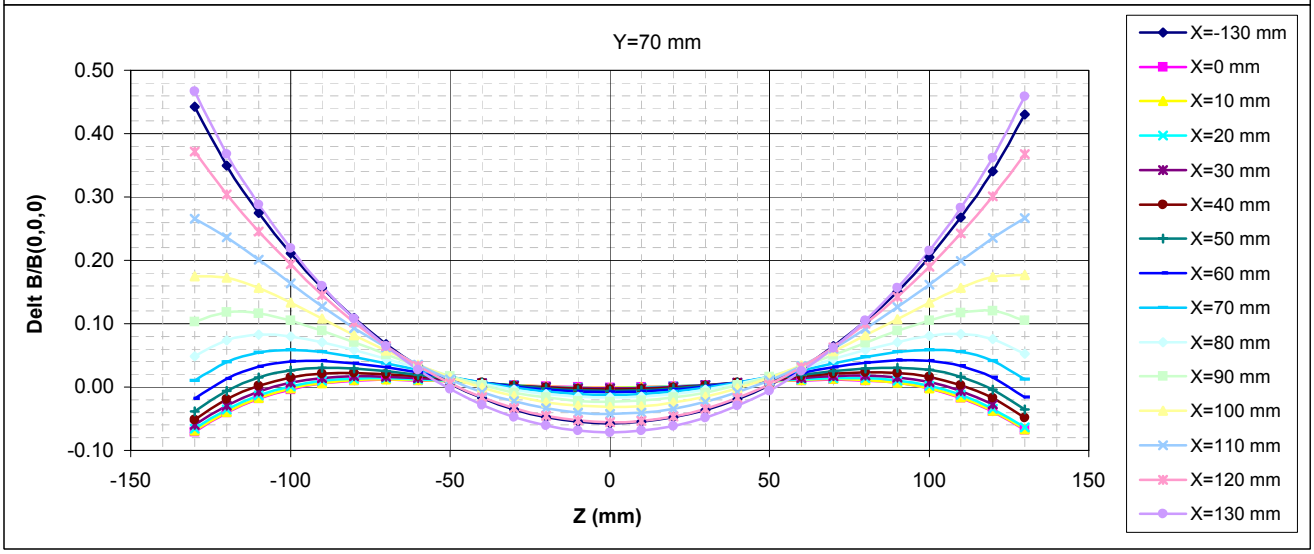


GMW Associates
Electromagnet Field Uniformity Plot

Model:	5503	Engr:	Y. Qin
Serial No:	1	Date:	7/16/2007
Contract No:		Page:	1 of 2

Power supply:	PowerTen P83C-100150, 100V/150A
Power supply SN:	0250A00730
Current Reading:	DF860R, 200A max, SN: 10043006
Field Reading:	Senis 3-axis, 2T, 1% probe, for noted data points
Note 1:	Read field and current using Agilent 34970A, SN:USA37035272
Note 2:	B=(Bx^2+Bz^2)^(1/2) Btotal=(Bx^2+By^2+Bz^2)^(1/2)
Pole Gap:	300 mm
Pole Face (Radius):	200 mm
Position:	Y=70mm

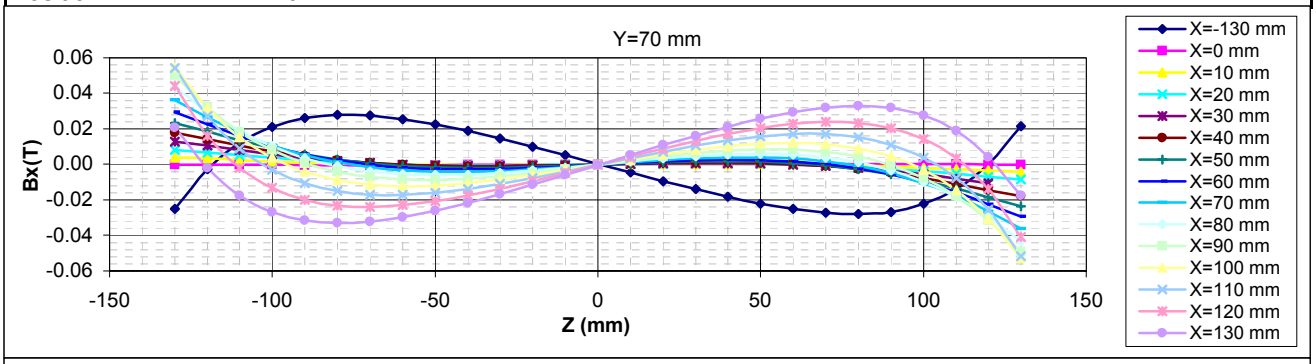


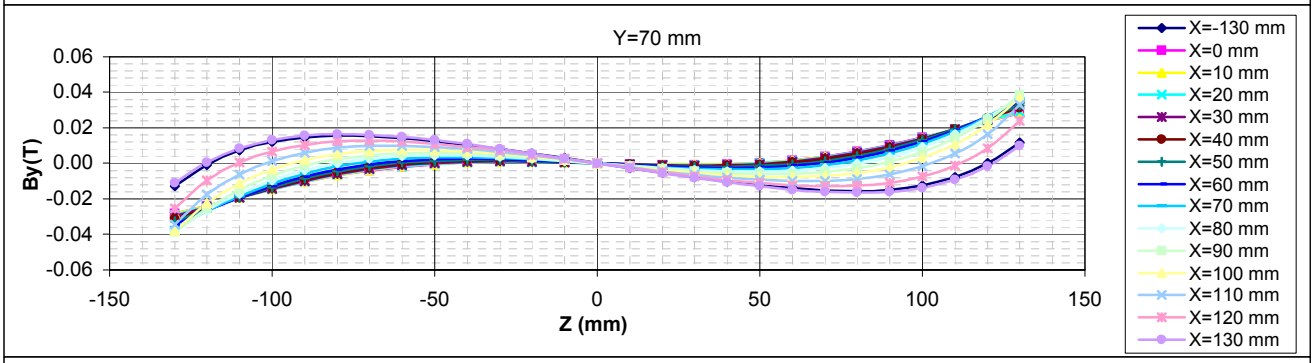


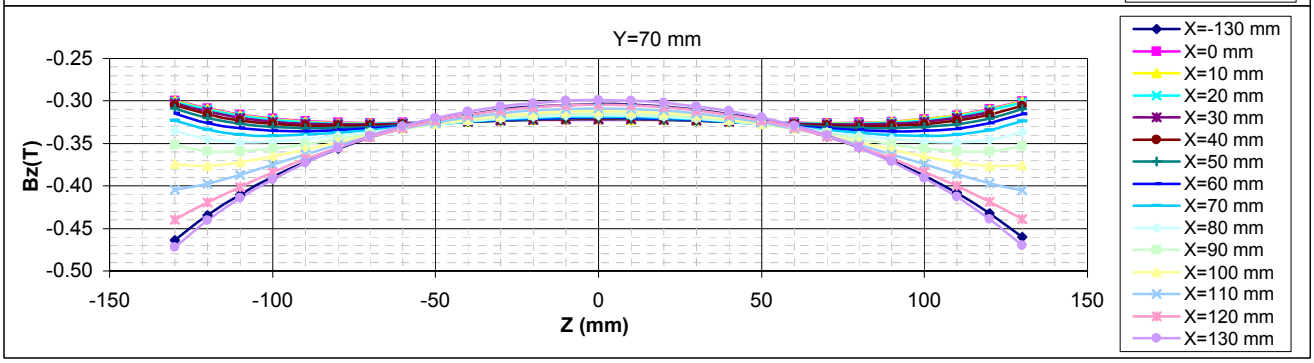
GMW Associates
Electromagnet Field Uniformity Plot

Model:	5503	Engr:	Y. Qin
Serial No:	1	Date:	7/16/2007
Contract No:		Page:	2 of 2

Power supply:	PowerTen P83C-100150, 100V/150A
Power supply SN:	0250A00730
Current Reading:	DF860R, 200A max, SN: 10043006
Field Reading:	Senis 3-axis, 2T, 1% probe, for noted data points
Note 1:	Read field and current using Agilent 34970A, SN:USA37035272
Note 2:	B=(Bx^2+Bz^2)^(1/2) Btotal=(Bx^2+By^2+Bz^2)^(1/2)
Pole Gap:	300 mm
Pole Face (Radius):	200 mm
Position:	Y=70mm



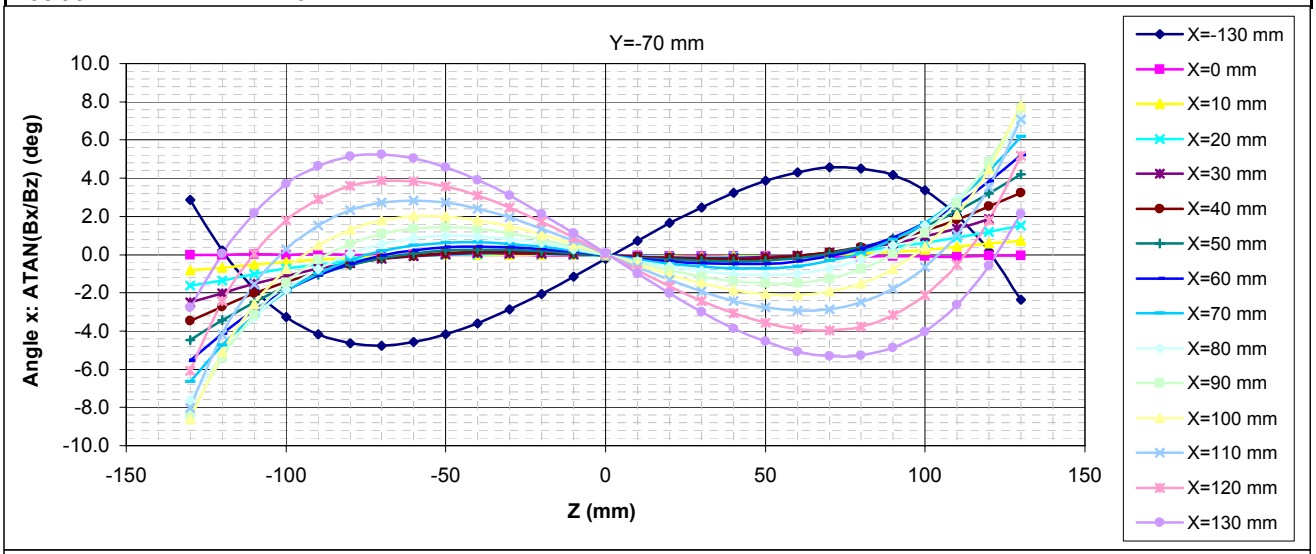


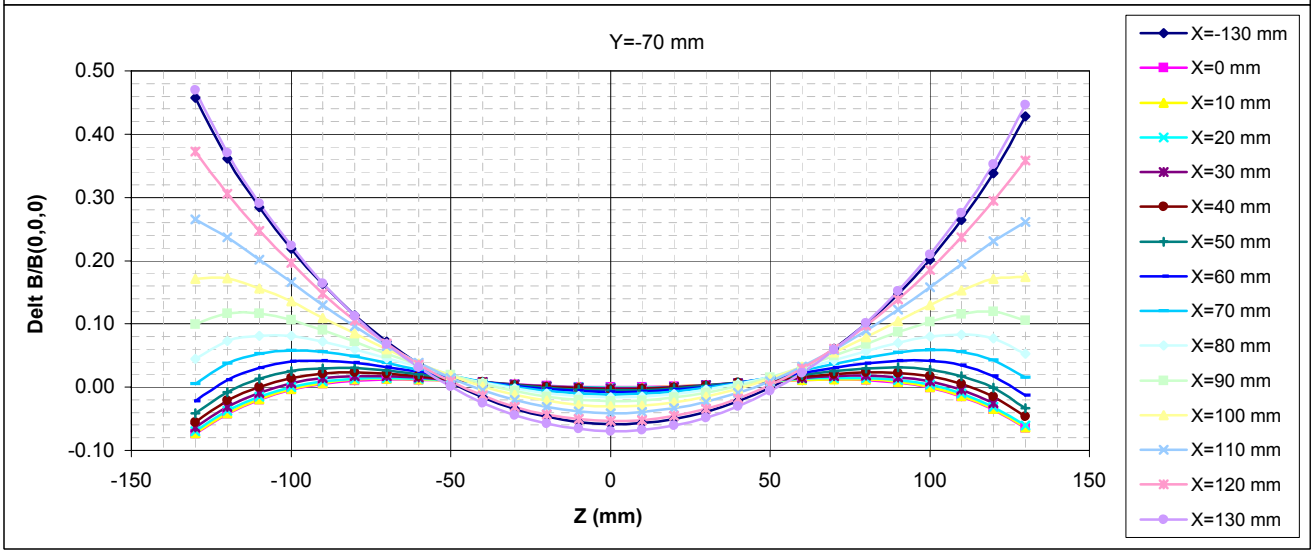


GMW Associates
Electromagnet Field Uniformity Plot

Model:	5503	Engr:	Y. Qin
Serial No:	1	Date:	7/16/2007
Contract No:		Page:	1 of 2

Power supply:	PowerTen P83C-100150, 100V/150A
Power supply SN:	0250A00730
Current Reading:	DF860R, 200A max, SN: 10043006
Field Reading:	Senis 3-axis, 2T, 1% probe, for noted data points
Note 1:	Read field and current using Agilent 34970A, SN:USA37035272
Note 2:	B=(Bx^2+Bz^2)^(1/2) Btotal=(Bx^2+By^2+Bz^2)^(1/2)
Pole Gap:	300 mm
Pole Face (Radius):	200 mm
Position:	Y=-70mm





GMW Associates
Electromagnet Field Uniformity Plot

Model:	5503	Engr:	Y. Qin
Serial No:	1	Date:	7/16/2007
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Power supply:	PowerTen P83C-100150, 100V/150A
Power supply SN:	0250A00730
Current Reading:	DF860R, 200A max, SN: 10043006
Field Reading:	Senis 3-axis, 2T, 1% probe, for noted data points
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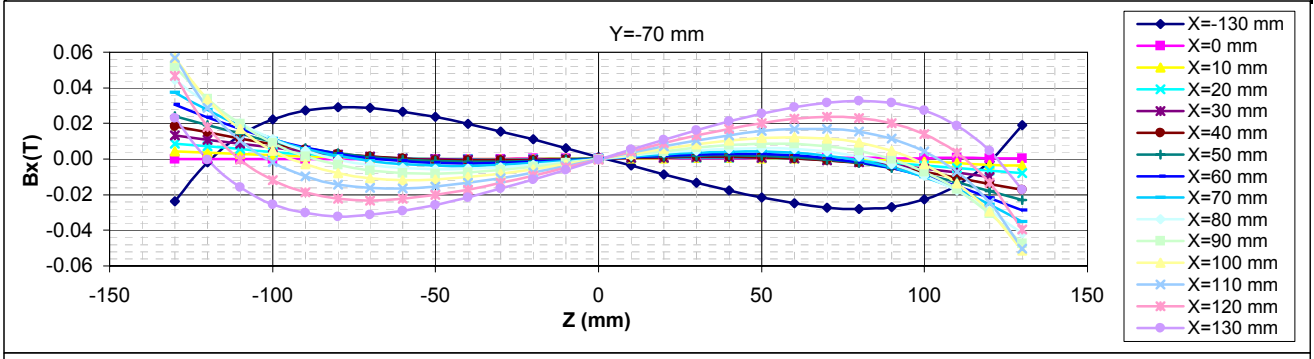
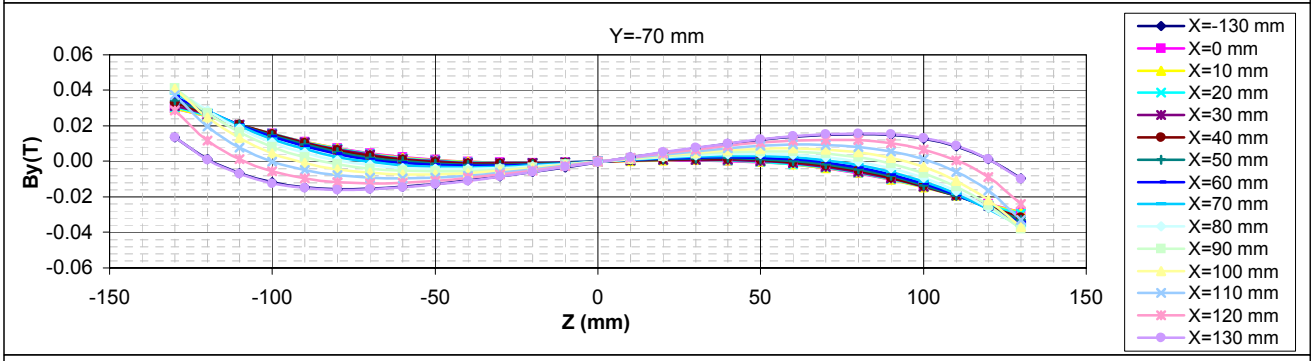
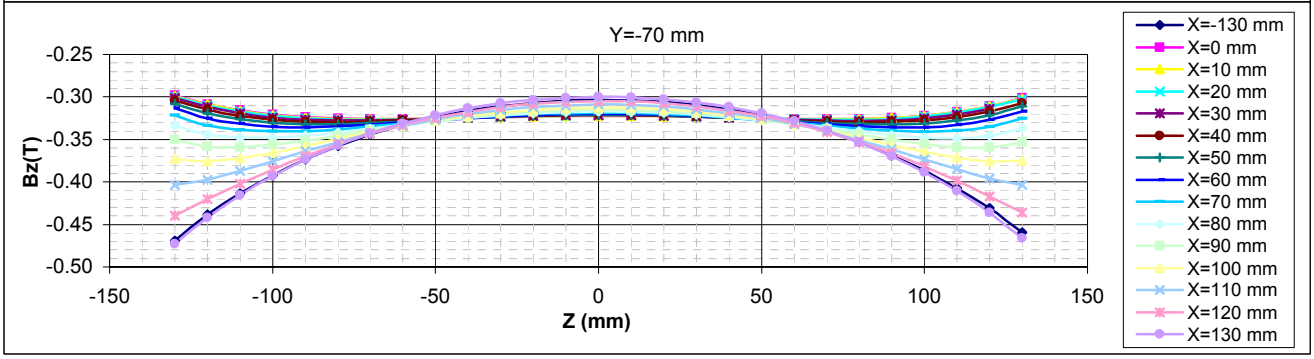
Pole Gap:	300 mm
Pole Face (Radius):	200 mm
Position:	Y=-70mm



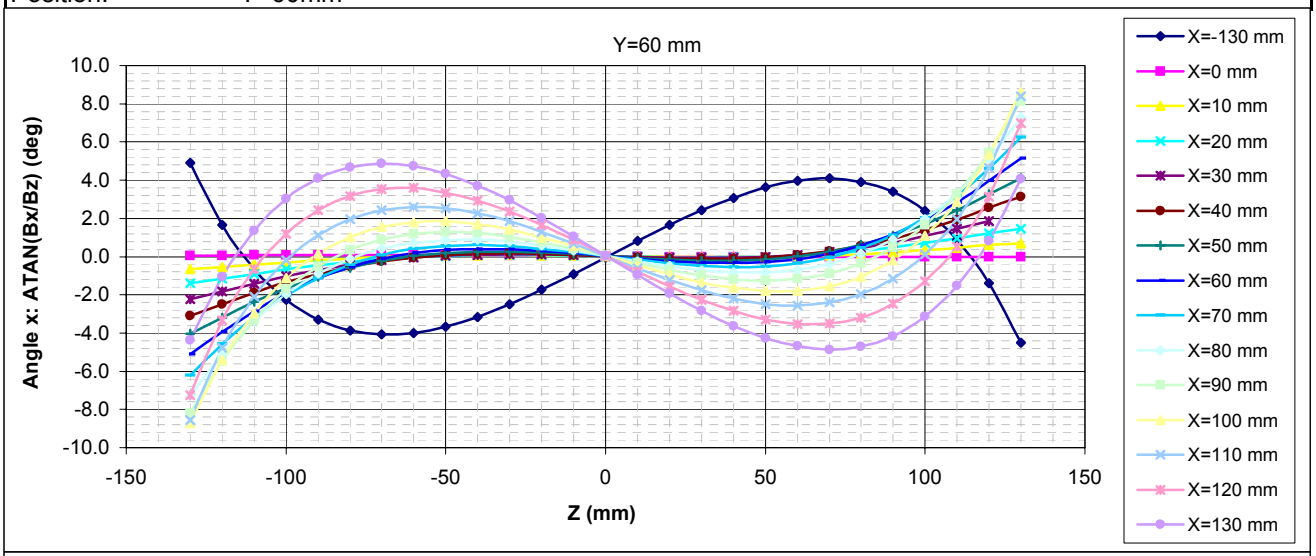


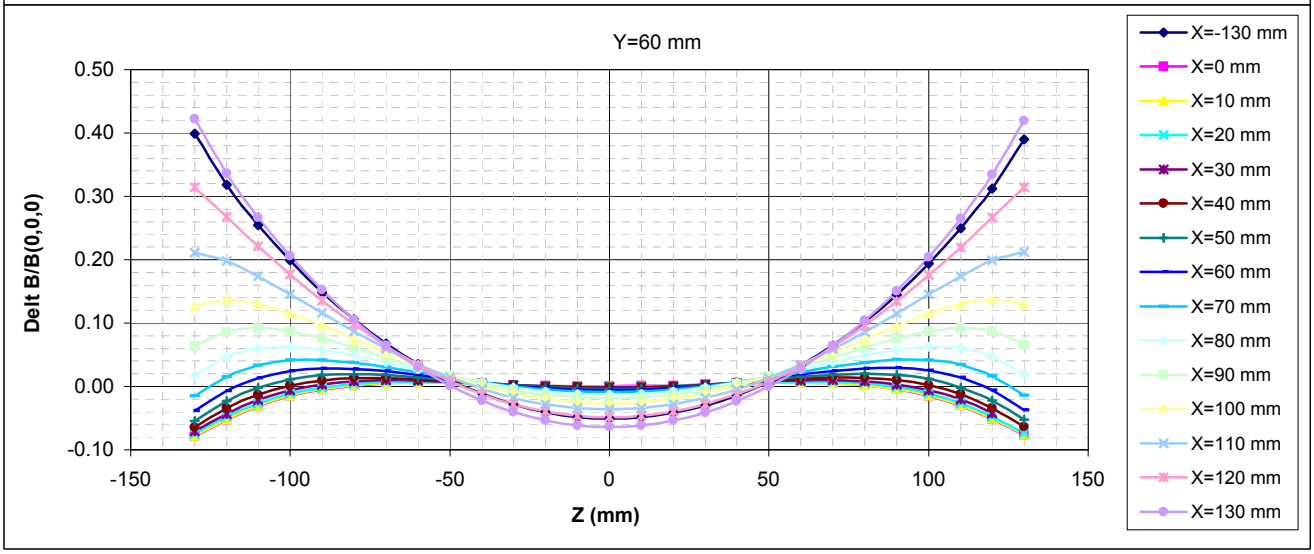


GMW Associates
Electromagnet Field Uniformity Plot

Model:	5503	Engr:	Y. Qin
Serial No:	1	Date:	7/16/2007
Contract No:		Page:	1 of 2

Power supply:	PowerTen P83C-100150, 100V/150A
Power supply SN:	0250A00730
Current Reading:	DF860R, 200A max, SN: 10043006
Field Reading:	Senis 3-axis, 2T, 1% probe, for noted data points
Note 1:	Read field and current using Agilent 34970A, SN:USA37035272
Note 2:	B=(Bx^2+Bz^2)^(1/2) Btotal=(Bx^2+By^2+Bz^2)^(1/2)
Pole Gap:	300 mm
Pole Face (Radius):	200 mm
Position:	Y=60mm





GMW Associates
Electromagnet Field Uniformity Plot

Model:	5503	Engr:	Y. Qin
Serial No:	1	Date:	7/16/2007
Contract No:		Page:	2 of 2

Power supply:	PowerTen P83C-100150, 100V/150A
Power supply SN:	0250A00730
Current Reading:	DF860R, 200A max, SN: 10043006
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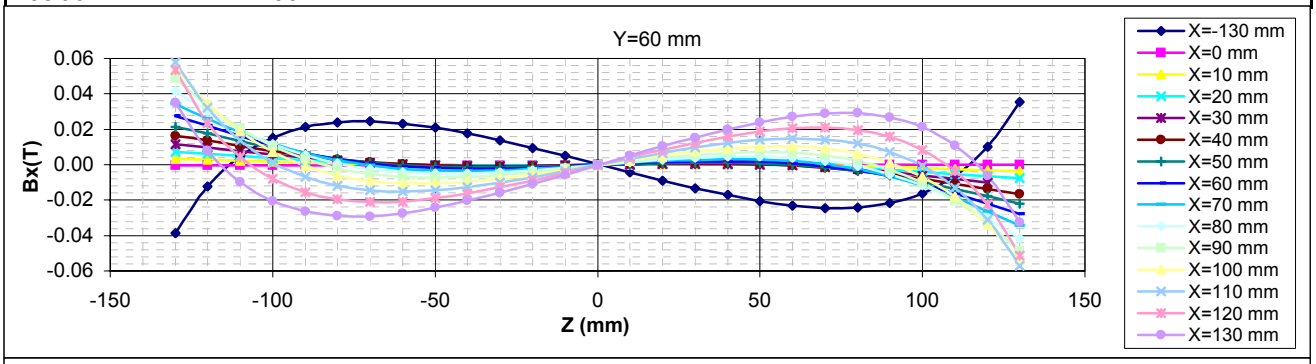
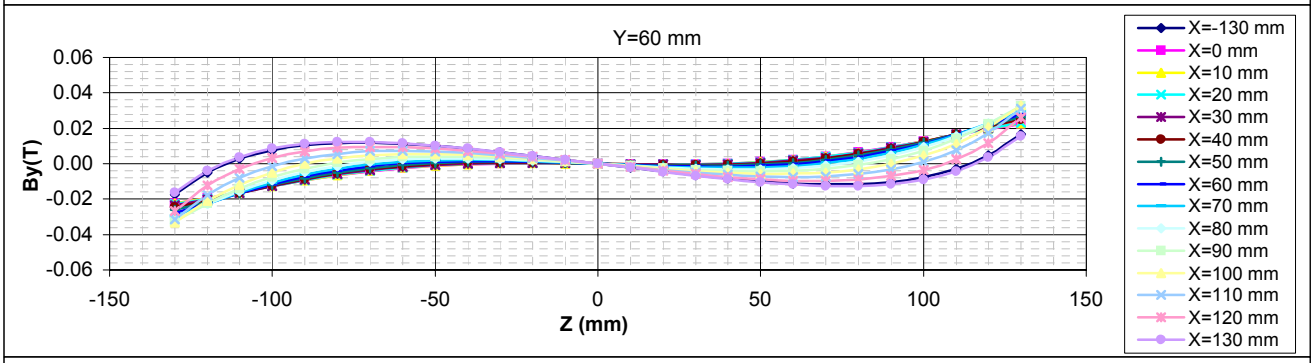
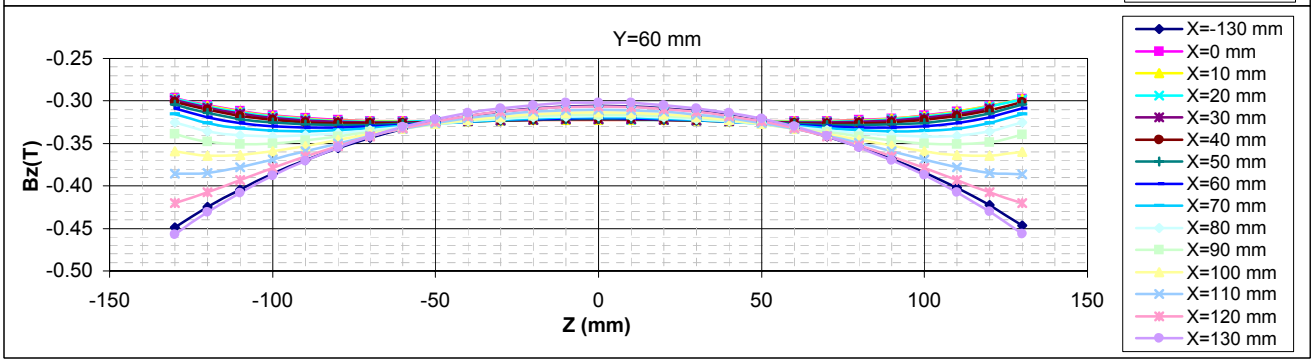
Note 1:	Read field and current using Agilent 34970A, SN:USA37035272
Note 2:	B=(Bx^2+Bz^2)^(1/2) Btotal=(Bx^2+By^2+Bz^2)^(1/2)
Pole Gap:	300 mm
Pole Face (Radius):	200 mm
Position:	Y=60mm



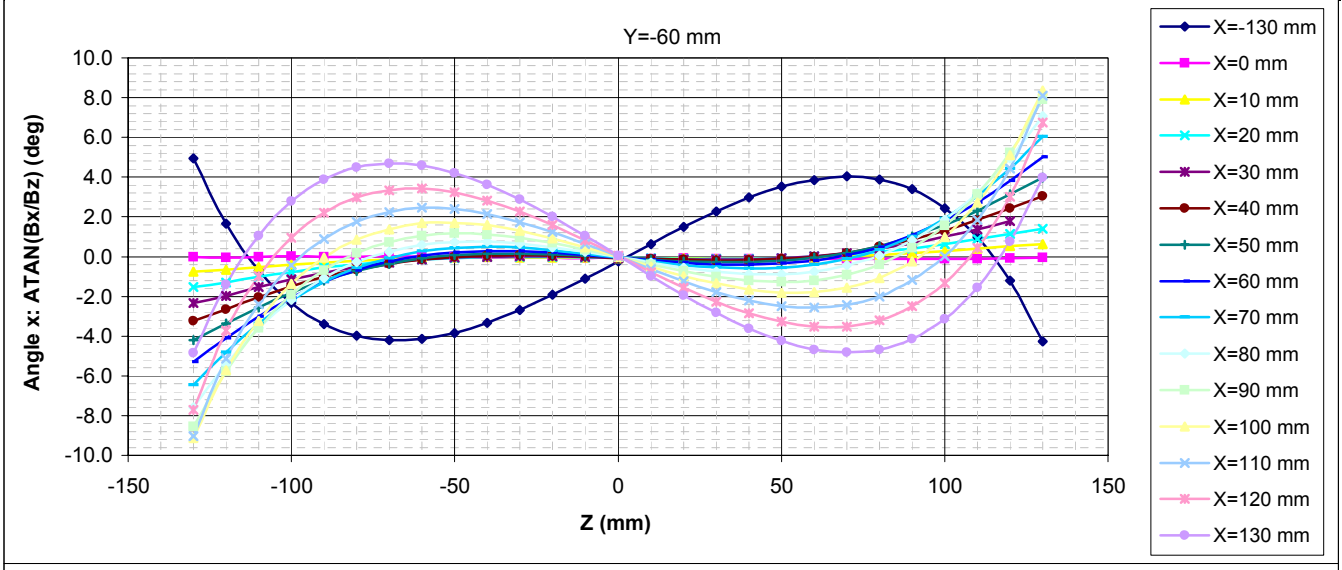


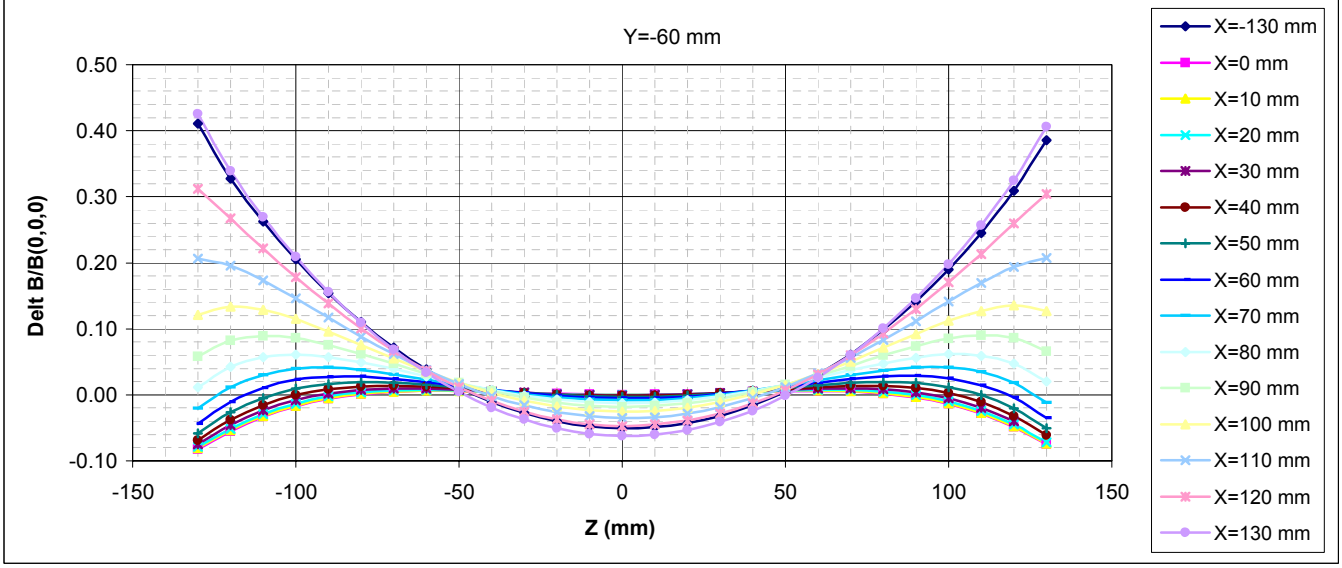


GMW Associates
Electromagnet Field Uniformity Plot

Model:	5503	Engr:	Y. Qin
Serial No:	1	Date:	7/16/2007
Contract No:		Page:	1 of 2

Power supply:	PowerTen P83C-100150, 100V/150A
Power supply SN:	0250A00730
Current Reading:	DF860R, 200A max, SN: 10043006
Field Reading:	Senis 3-axis, 2T, 1% probe, for noted data points
Note 1:	Read field and current using Agilent 34970A, SN:USA37035272
Note 2:	B=(Bx^2+Bz^2)^(1/2) Btotal=(Bx^2+By^2+Bz^2)^(1/2)
Pole Gap:	300 mm
Pole Face (Radius):	200 mm
Position:	Y=-60mm

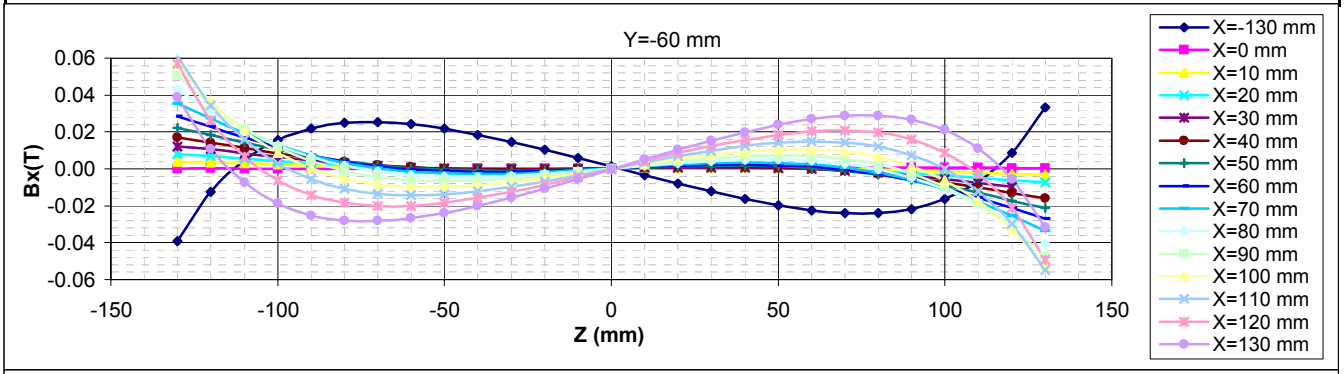


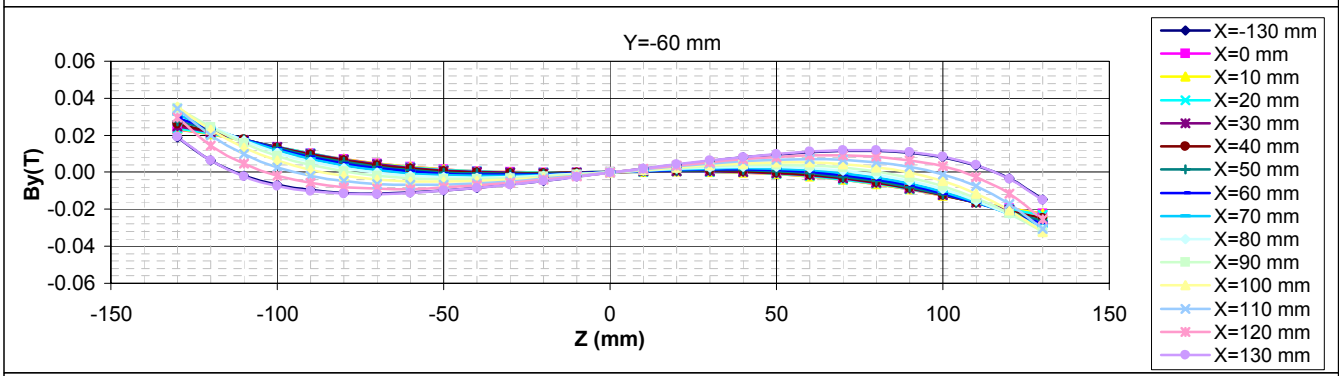


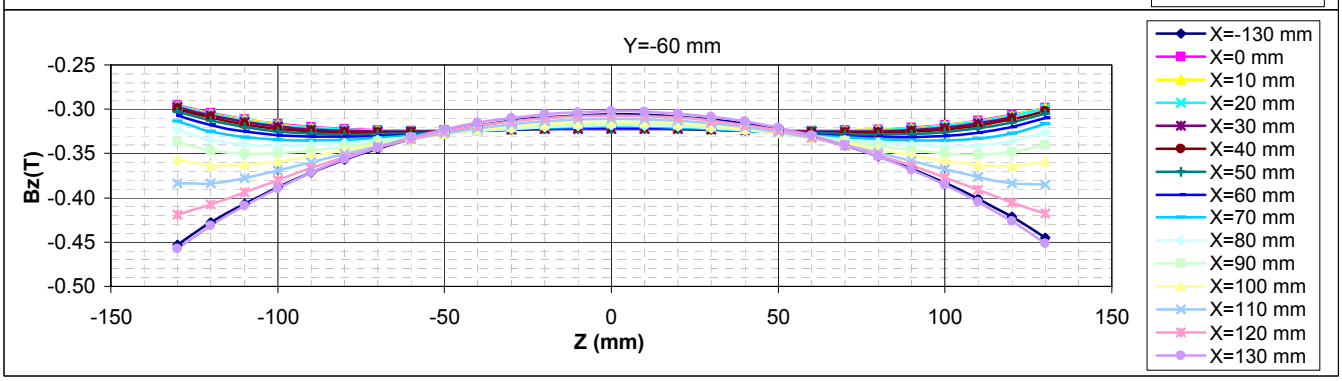
GMW Associates
Electromagnet Field Uniformity Plot

Model:	5503	Engr:	Y. Qin
Serial No:	1	Date:	7/16/2007
Contract No:		Page:	2 of 2

Power supply:	PowerTen P83C-100150, 100V/150A
Power supply SN:	0250A00730
Current Reading:	DF860R, 200A max, SN: 10043006
Field Reading:	Senis 3-axis, 2T, 1% probe, for noted data points
Note 1:	Read field and current using Agilent 34970A, SN:USA37035272
Note 2:	B=(Bx^2+Bz^2)^(1/2) Btotal=(Bx^2+By^2+Bz^2)^(1/2)
Pole Gap:	300 mm
Pole Face (Radius):	200 mm
Position:	Y=-60mm



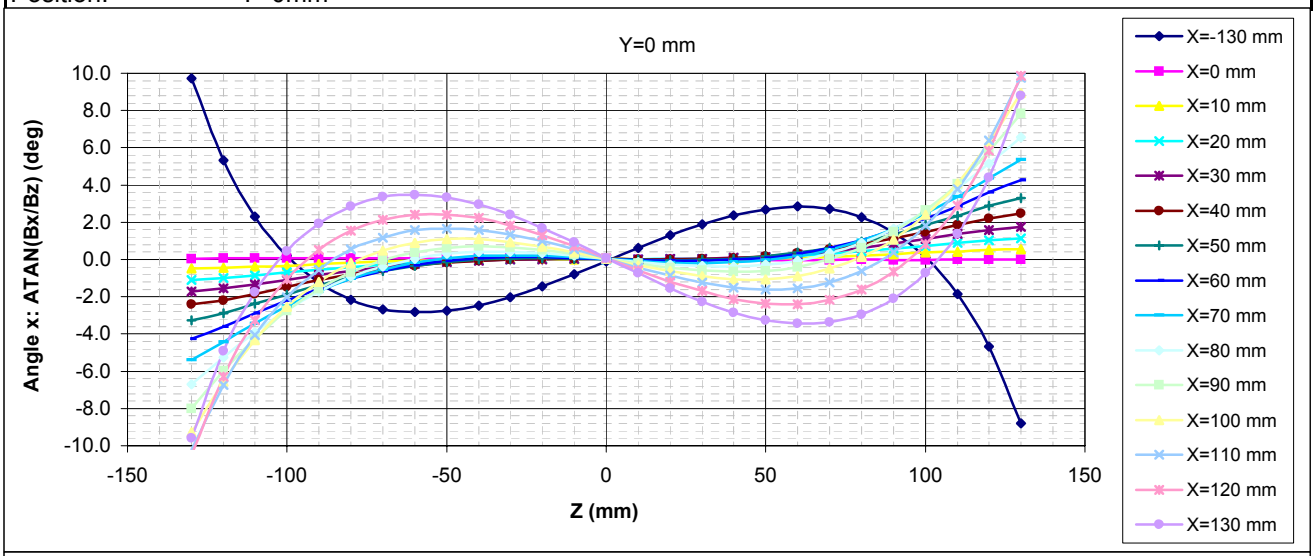


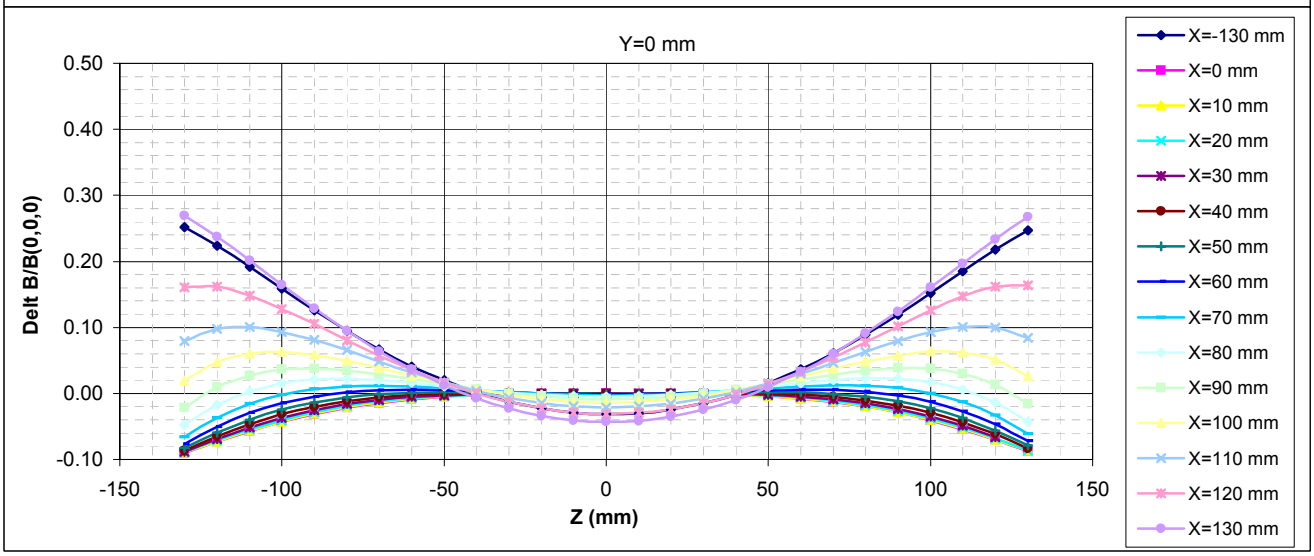


GMW Associates
Electromagnet Field Uniformity Plot

Model:	5503	Engr:	Y. Qin
Serial No:	1	Date:	7/16/2007
Contract No:		Page:	1 of 2

Power supply:	PowerTen P83C-100150, 100V/150A
Power supply SN:	0250A00730
Current Reading:	DF860R, 200A max, SN: 10043006
Field Reading:	Senis 3-axis, 2T, 1% probe, for noted data points
Note 1:	Read field and current using Agilent 34970A, SN:USA37035272
Note 2:	B=(Bx^2+Bz^2)^(1/2) Btotal=(Bx^2+By^2+Bz^2)^(1/2)
Pole Gap:	300 mm
Pole Face (Radius):	200 mm
Position:	Y=0mm

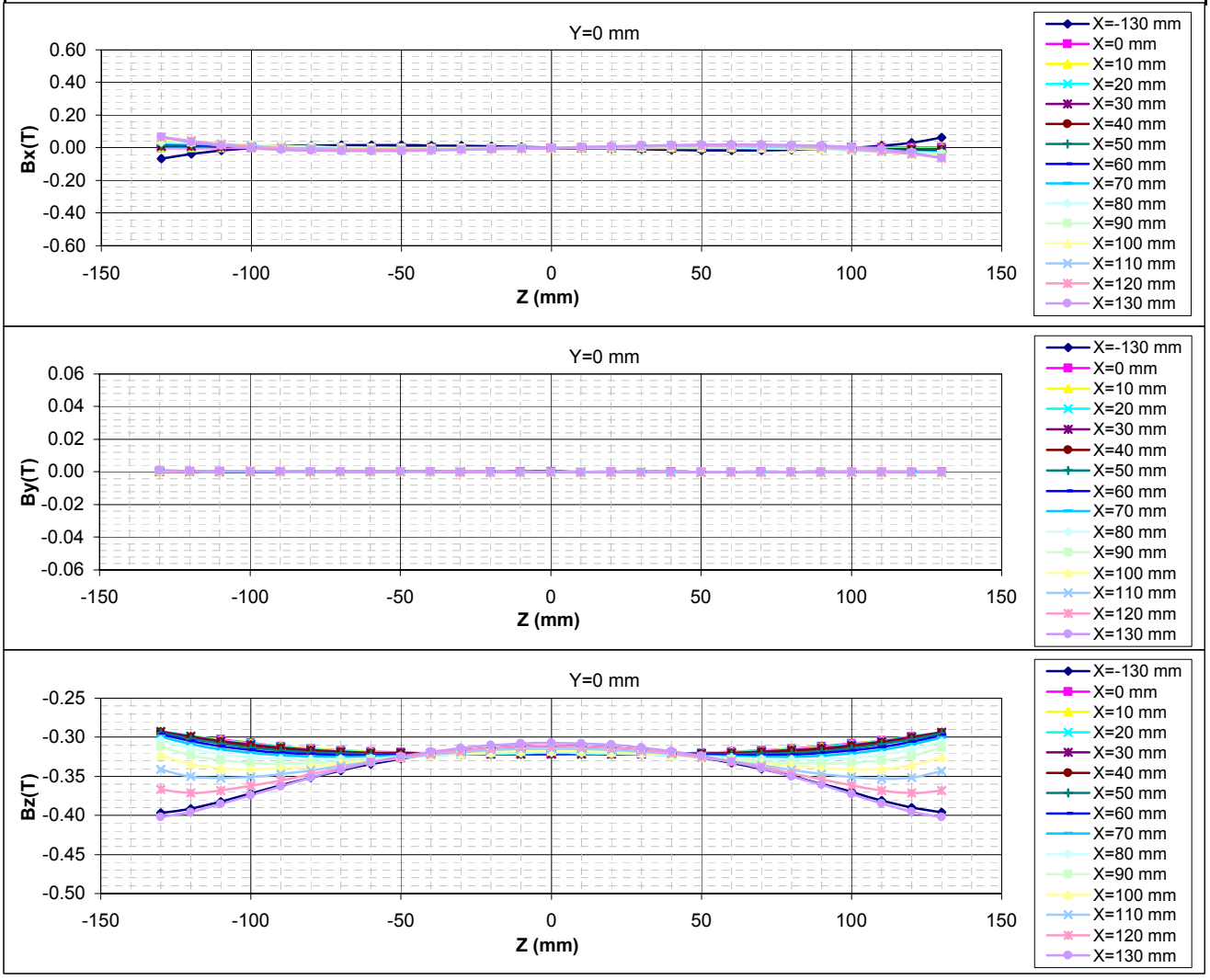




GMW Associates
Electromagnet Field Uniformity Plot

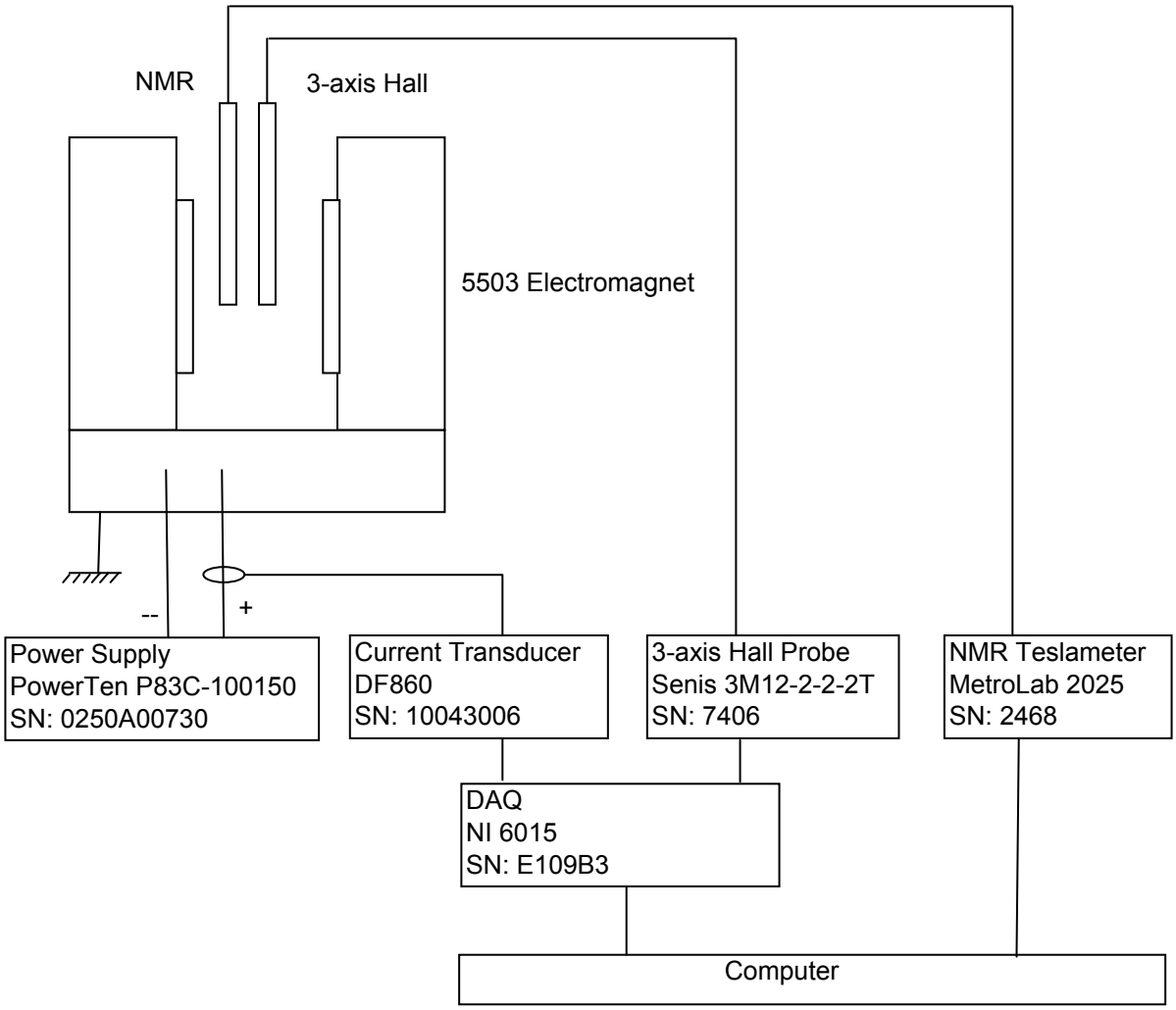
Model:	5503	Engr:	Y. Qin
Serial No:	1	Date:	7/16/2007
Contract No:		Page:	2 of 2

Power supply:	PowerTen P83C-100150, 100V/150A
Power supply SN:	0250A00730
Current Reading:	DF860R, 200A max, SN: 10043006
Field Reading:	Senis 3-axis, 2T, 1% probe, for noted data points
Note 1:	Read field and current using Agilent 34970A, SN:USA37035272
Note 2:	B=(Bx^2+Bz^2)^(1/2) Btotal=(Bx^2+By^2+Bz^2)^(1/2)
Pole Gap:	300 mm
Pole Face (Radius):	200 mm
Position:	Y=0mm



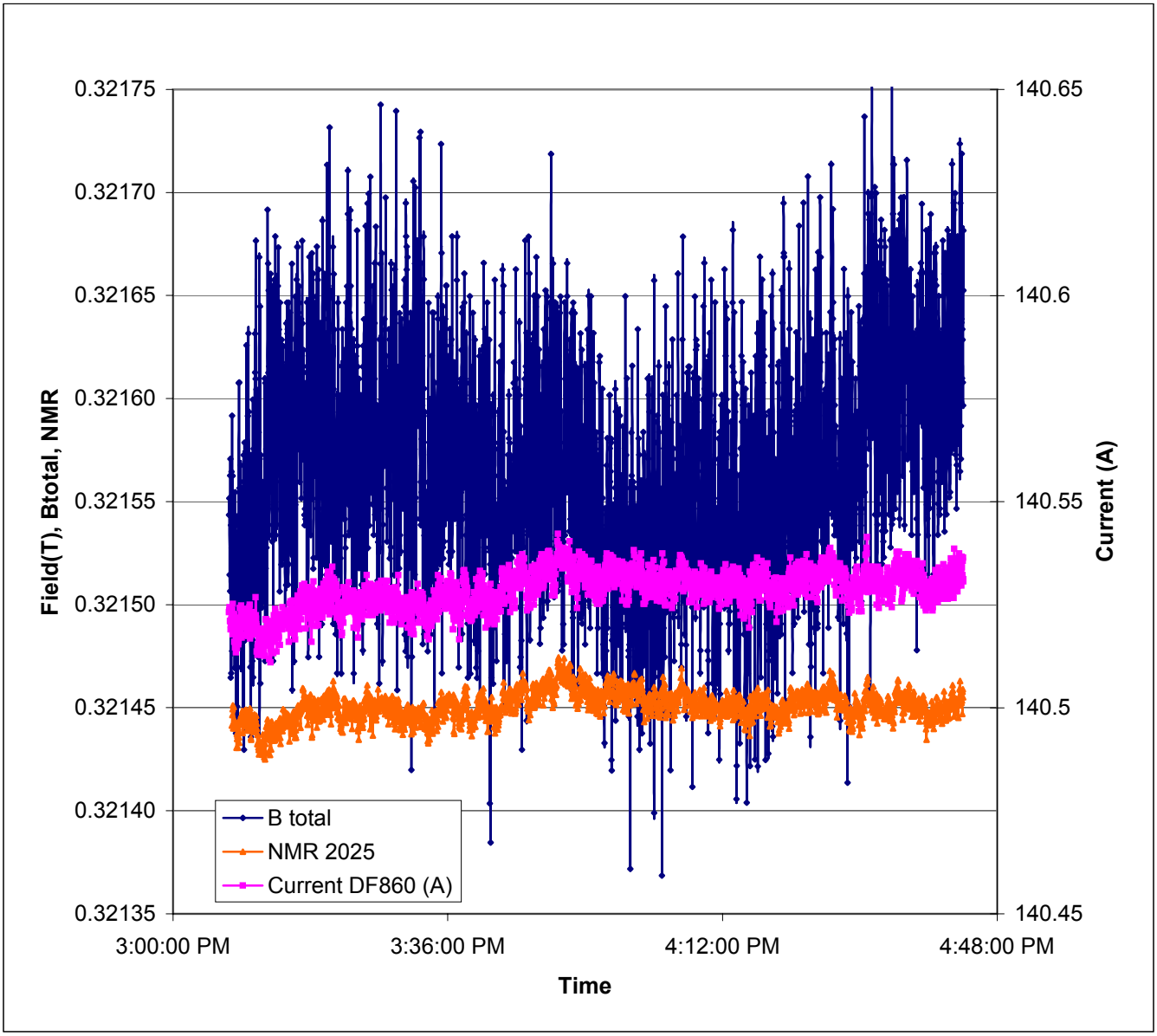
GMW Associates
Electromagnet Stability Plot
Calibration of Field vs Current

Model:	5503	Engr:	Y. Qin
Serial No:	1	Date:	7/16/2007
Contract No:		Page:	1 of 2
Power supply:	PowerTen P83C-100150, 100V/150A, SN: 0250A00730		
Current Reading:	DF860R, 200A max, SN: 10043006		
Field Reading 1:	Senis 3-axis, 2T, 1% probe, SN:7406		
Field Reading 2:	METROLAB NMR, Model 2025, SN: 2468		
Note:	Read field and current using NI DAQPad6015, SN: E109B3		
Pole Gap:	300 mm		
Pole Face (Radius)	200 mm		



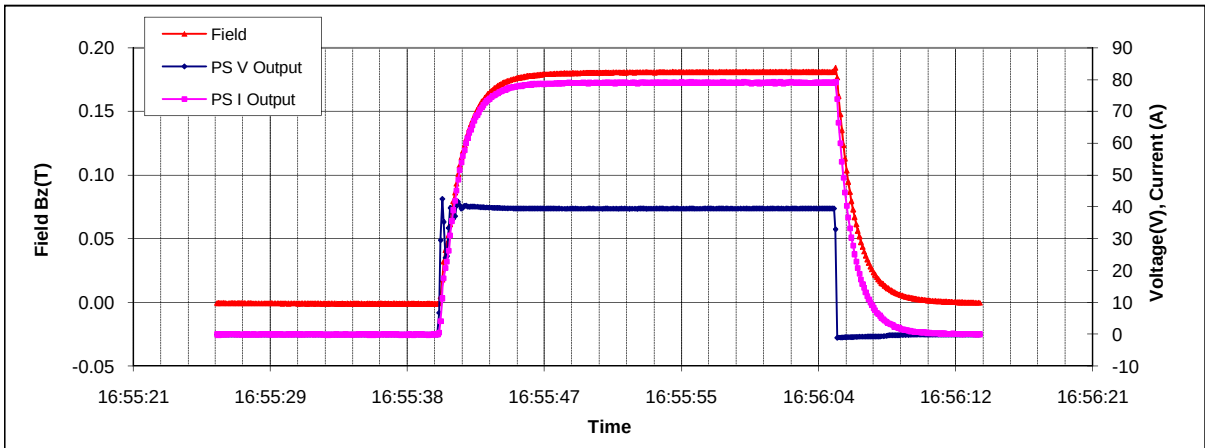
GMW Associates
Electromagnet Stability Plot
Calibration of Field vs Current

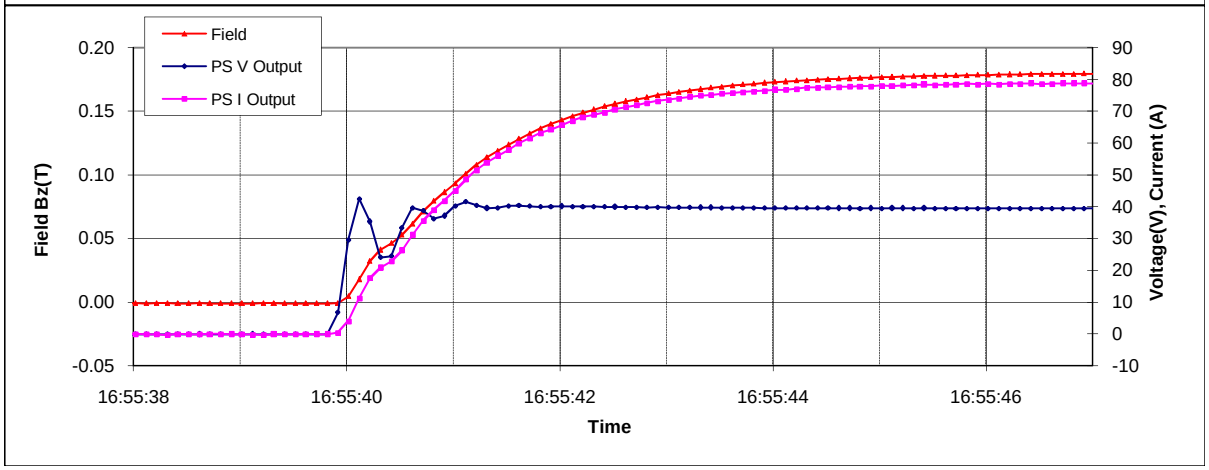
Model:	5503	Engr:	Y. Qin
Serial No:	1	Date:	7/16/2007
Contract No:		Page:	2 of 2
Power supply:	PowerTen P83C-100150, 100V/150A, SN: 0250A00730		
Current Reading:	DF860R, 200A max, SN: 10043006		
Field Reading 1:	Senis 3-axis, 2T, 1% probe, SN:7406		
Field Reading 2:	METROLAB NMR, Model 2025, SN: 2468		
Note:	Read field and current using NI DAQPad6015, SN: E109B3		
Pole Gap:	300 mm		
Pole Face (Radius):	200 mm		



GMW Associates
Electromagnet Excitation Plot
Square waveform

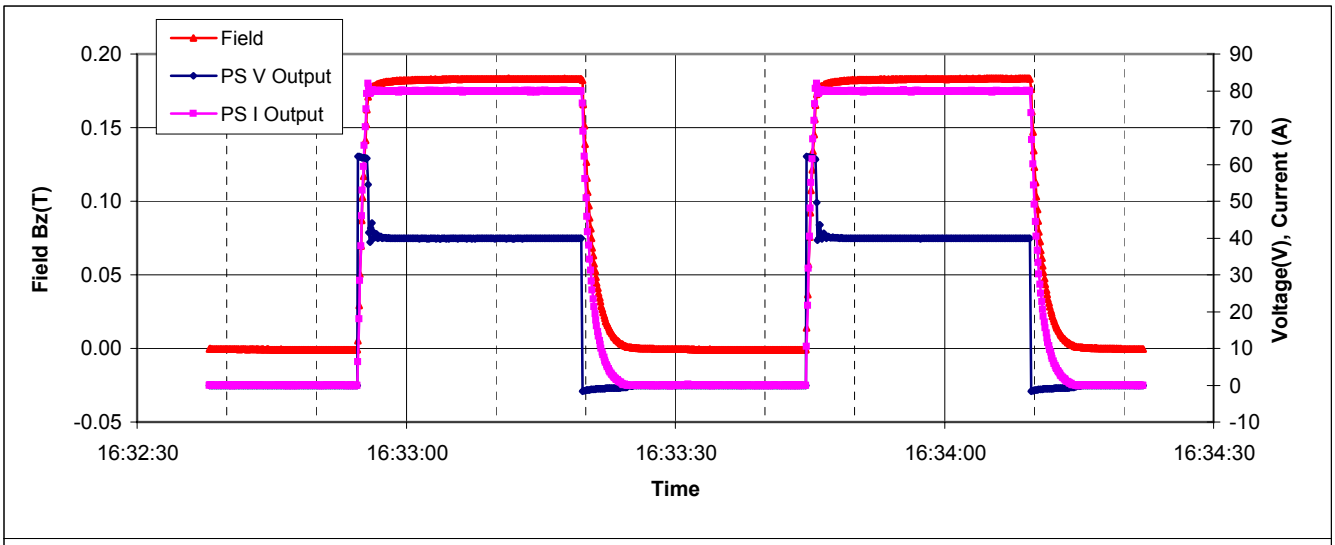
Model:	5503	Engr:	Y. Qin
Serial No:	1	Date:	7/16/2007
Contract No:		Page:	1 of 1
Power supply:	Sorensen SGA 60/83C-0AAA, 60V/83A		
Power supply SN:	0719A01694		
Current Reading:	DF860R, 200A max, SN: 10043006		
Field Reading:	Senis 3-axis, 2T, 1% probe		
Note 1:	Read field and current using NI DAQPad6015		
Note 2:	Max current 80A, square wave, 0.02Hz		
Note 3:	With a RC filter on Vprogram, 216 ohm, 4700uF, 1 second		
Pole Gap:	300 mm		
Pole Face (Radius):	200 mm		

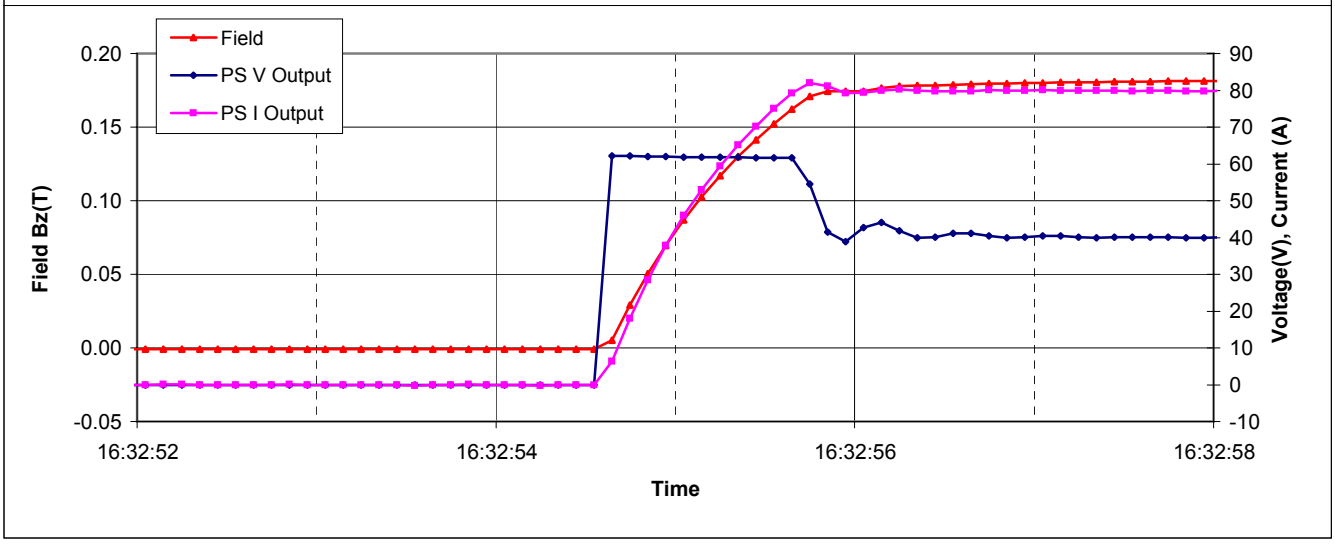




GMW Associates
Electromagnet Excitation Plot
Square waveform

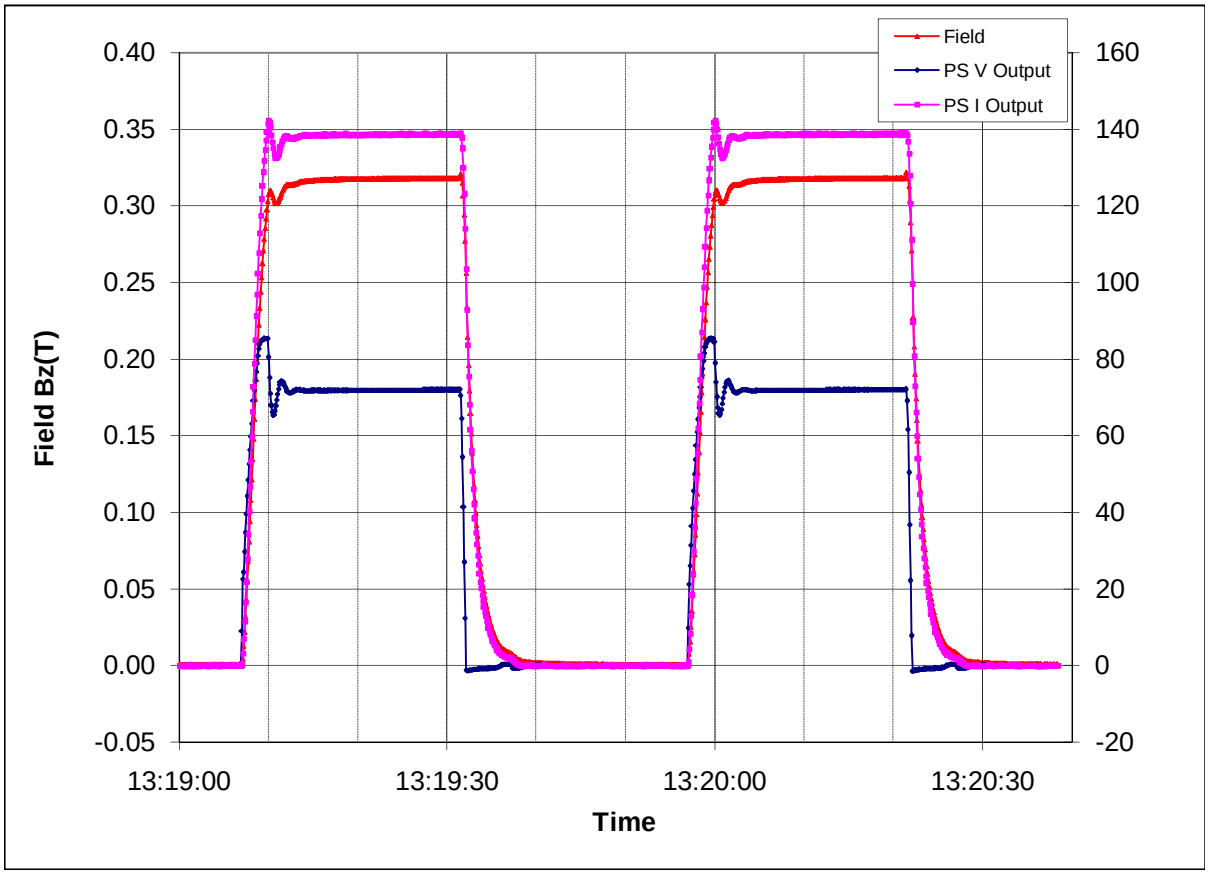
Model:	5503	Engr:	Y. Qin
Serial No:	1	Date:	7/16/2007
Contract No:		Page:	1 of 1
Power supply:	Sorensen SGA 60/83C-0AAA, 60V/83A		
Power supply SN:	0719A01694		
Current Reading:	DF860R, 200A max, SN: 10043006		
Field Reading:	Senis 3-axis, 2T, 1% probe		
Note 1:	Read field and current using NI DAQPad6015		
Note 2:	Max current 80A, square wave, 0.02Hz		
Note 3:	Without a RC filter on Vprogram		
Pole Gap:	300 mm		
Pole Face (Radius):	200 mm		





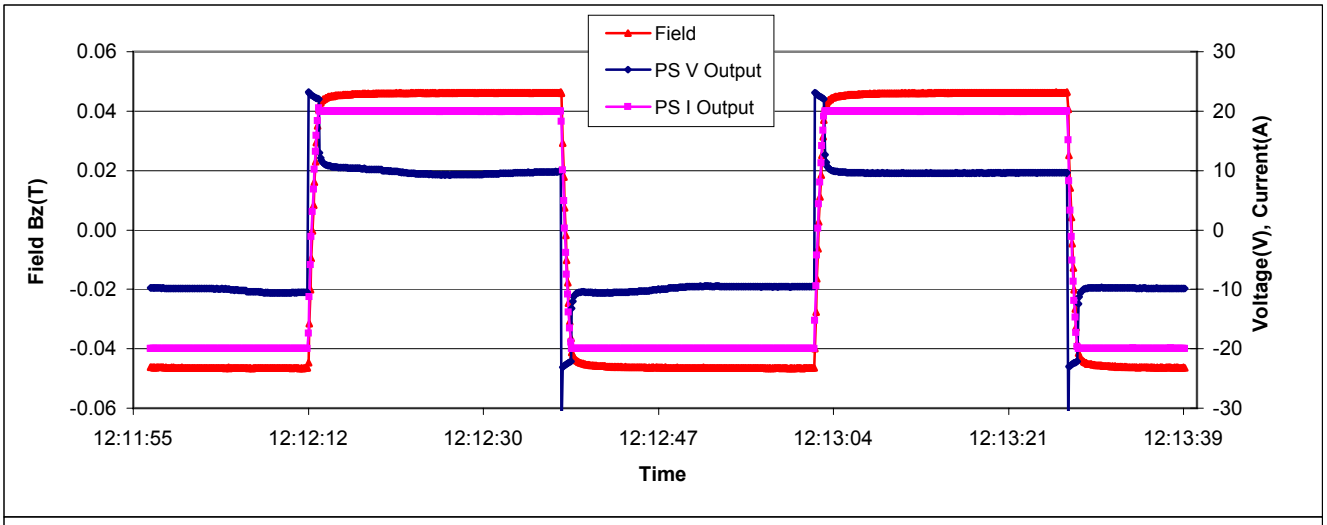
GMW Associates
Electromagnet Excitation Plot
Square waveform

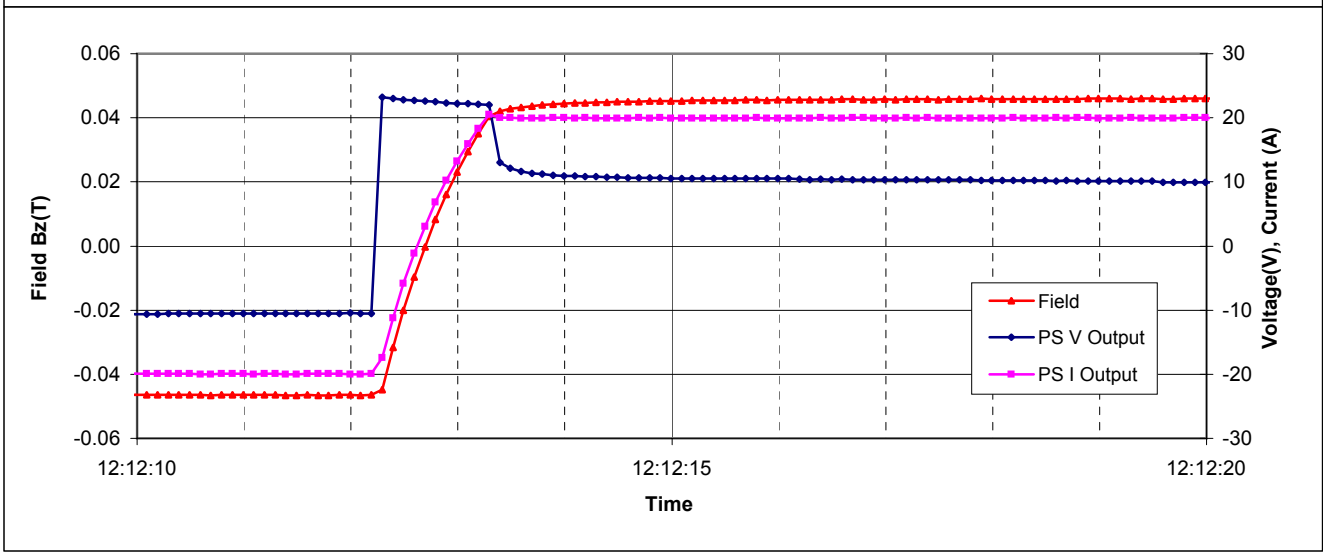
Model:	5503	Engr:	Y. Qin
Serial No:	1	Date:	7/16/2007
Contract No:		Page:	1 of 2
Power supply:	PowerTen P83C-100150, 100V/150A		
Power supply SN:	0250A00730		
Current Reading:	DF860R, 200A max, SN: 10043006		
Field Reading:	Senis 3-axis, 2T, 1% probe		
Note 1:	Read field and current using NI DAQPad6015		
Note 2:	Max current 140A, square wave, 0.02Hz		
Pole Gap:	300 mm		
Pole Face (Radius):	200 mm		



GMW Associates
Electromagnet Excitation Plot
Square waveform

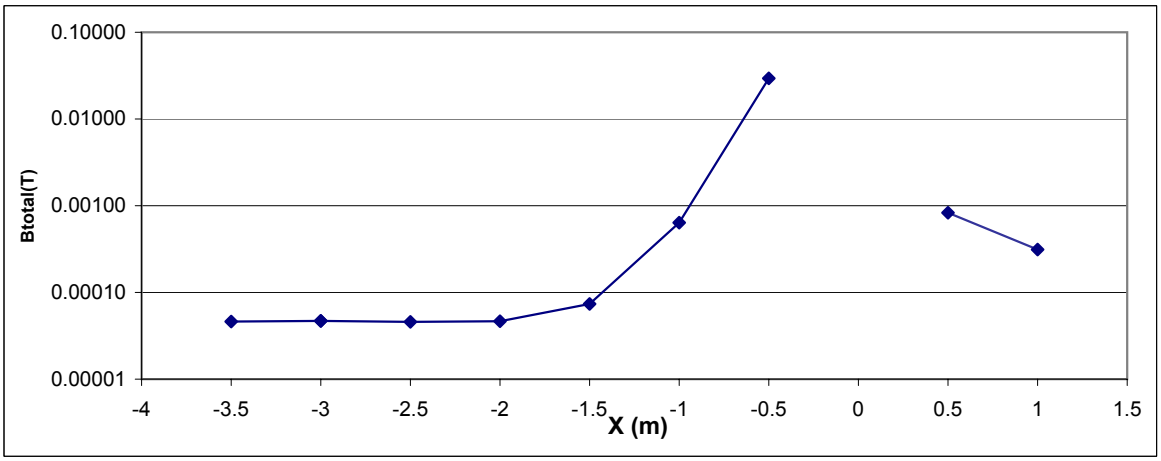
Model:	5503	Engr:	Y. Qin
Serial No:	1	Date:	7/16/2007
Contract No:		Page:	2 of 2
Power supply:	Kepco BOP-20-20, 20V/20A		
Power supply SN:			
Current Reading:	DF860R, 200A max, SN: 10043006		
Field Reading:	Senis 3-axis, 2T, 1% probe		
Note 1:	Read field and current using NI DAQPad6015		
Note 2:	Max current 20A, square wave, 0.02Hz		
Pole Gap:	300 mm		
Pole Face (Radius):	200 mm		
Inductance:	L=V/(ΔI/Δt)=33V/(40A/1.1second)=0.91H		



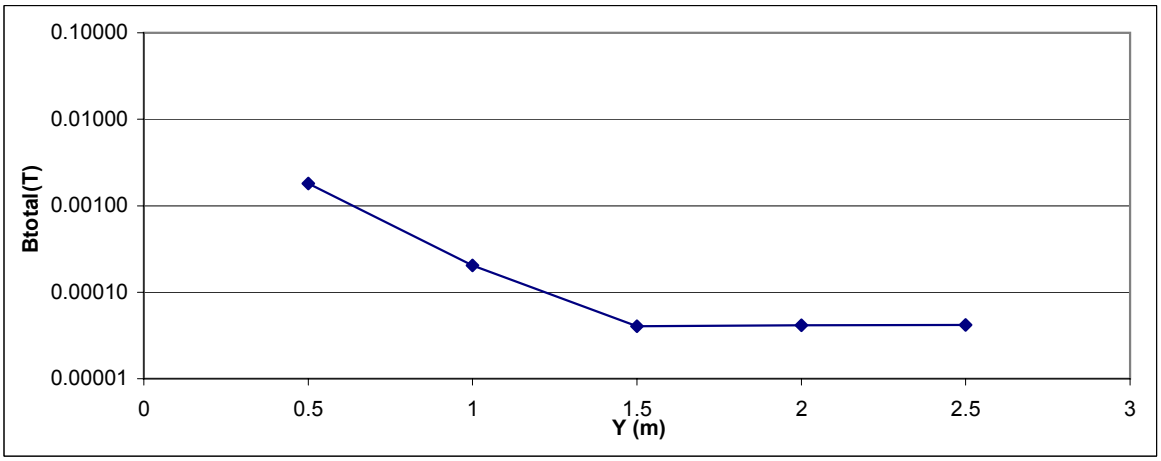


GMW Associates
Electromagnet Excitation Plot
Fringe Field Vs Distance

Model:	5503	Engr:	Y. Qin
Serial No:	1	Date:	7/16/2007
Contract No:		Page:	1 of 2
Power supply:	PowerTen P83C-100150, 100V/150A		
Power supply SN:	0250A00730		
Current Reading:	DF860R, 200A max, SN: 10043006		
Field Reading:	Senis 3-axis, 2T, 1% probe, for noted data points		
	Bartington Mag03-MC1000uT SN:1751 for all data points other than noted.		
Note 1:	Read field and current using Agilent 34970A, SN:USA37035272		
Pole Gap:	300 mm		
Pole Face (Radius):	200 mm		

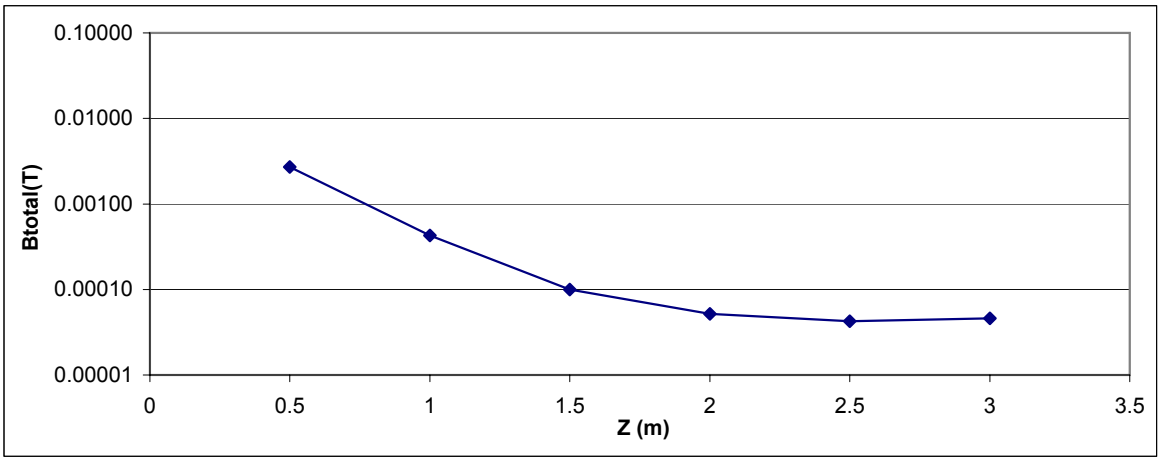


Note: Data at X=-0.5m, -1m measured with Senis 3-axis probe

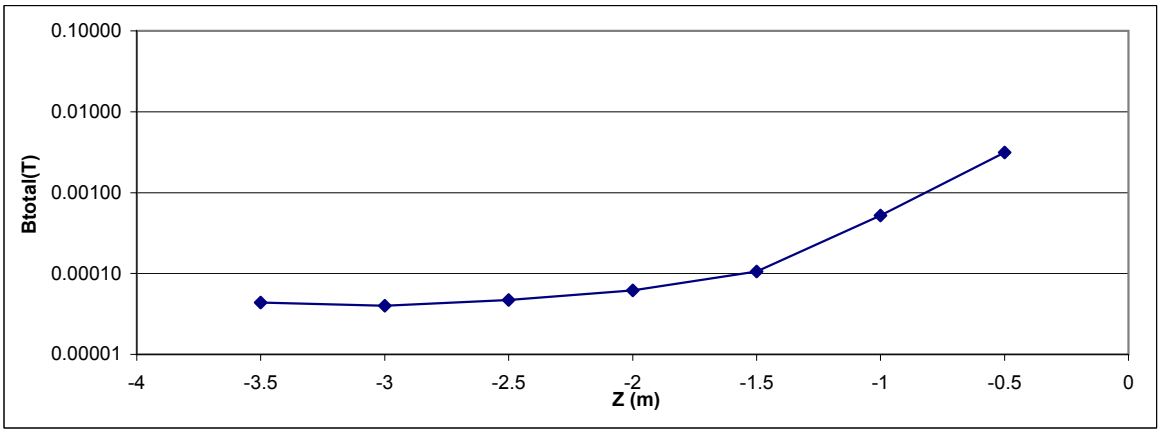


GMW Associates
Electromagnet Excitation Plot
Fringe Field Vs Distance

Model:	5503	Engr:	Y. Qin
Serial No:	1	Date:	7/16/2007
Contract No:		Page:	2 of 2
Power supply:	PowerTen P83C-100150, 100V/150A		
Power supply SN:	0250A00730		
Current Reading:	DF860R, 200A max, SN: 10043006		
Field Reading:	Senis 3-axis, 2T, 1%,probe, for noted data points		
	Bartington Mag03-MC1000uT SN:1751 for all data points other than noted.		
Note 1:	Read field and current using Agilent 34970A, SN:USA37035272		
Pole Gap:	300 mm		
Pole Face (Radius):	200 mm		



Note: Data at X=0.5m measured with Senis 3-axis probe



Note: Data at X=-0.5m measured with Senis 3-axis probe

Section 10

DRAWINGS

SERIES 3450/3450R/3455R/3455RBV 15 AMP THERMOSTATS

Typical Applications:

Power Supplies

Communication Equipment

Medical Equiopment

Computers (Where High AMP Loads are Present)

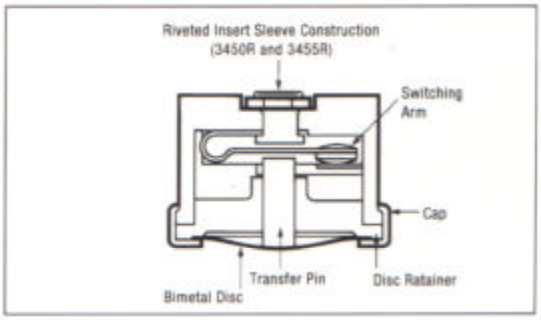
The Series 3450/3455R is a snap-acting, non-adjustable precision thermostat especially suited for industrial and electrical equipment.

The 3450 (.390" or 10mm overall) is ideal for applications that require precision control of high electric loads to 8 Amp resistive.

The 3450R and 3455R have a patented metal insert rivet construction.

The 3455R (.484" or 12.5mm) overall, has higher spacing as required by European approval agencies. Model 3455RBV is an epoxy overmold version of the 3455R, specifically designed for electrical insulation or protection in a high humidity environment. Consult factory for performance qualifications.

To insure that a safe combination of thermostat and application is achieved, the purchaser must determine product suitability for their individual requirements.



***Series 3450/3450R/3455R/3455RBV**

MODEL	ELECTRIC LIFE CYCLES	120 VAC	240 VAC	277VAC
3450	100,000	8.0A	-	-
3450R/	100,000	15A	8.3A	7.2A
3455R	100,000	4.4FLA 26.4LRA	2.2FLA 13.2LRA	-
	6,000	5.8FLA 34.8LRA	2.9FLA 17.4LRA	-
3455RBV	100,000	15A	8.3A	-
	6,000	5.8A 34.8LRA	2.9A 17.4LRA	-

A: Amps
FLA: Full Load Amps
LRA: Locked Rotor Amps
Contacts are available for millivolt and milliamp applications.
*Includes UL and CSA ratings.
Consult Elmwood Sensors for additional ratings.

Key Features:

- *Electric Rating to 15 Amp 120 VAC Resistive*
- *Environmental Exposure 0° to 350° F (–18° to 177° C)*
- *UL recognized and CSA certified and European Approved*
- *Single-Pole, Single-Throw (SPST)*
- *Pre-set and Tamperproof*
- *Variety of Mounting Brackets and Terminals Available*

SERIES 3450/3450R/3455R/3455RBV 15 AMP THERMOSTATS

Standard Temperature Characteristics

Operating Temperature Range The tightest specification determines the group	Tolerance Allowable* ± at mean temperature set points				Standard Mean Differential Nominal degrees between opening and closing points		Price Group*
	Open		Close				
	±°F	±°C	±°F	±°C	°F	°C	
32° to 79°F **0° to 25°C**	5	2.8	8	4.4	30-50	16-28	I
	5	2.8	7	3.9	25-29	14-16	II
	5	2.8	6	3.3	20-24	11-13	III
	5	2.8	6	3.3	15-19	8-11	IV
80° to 200°F **25° to 95°C**	5	2.8	8	4.4	30-50	16-28	I
	5	2.8	7	3.9	25-29	14-16	II
	5	2.8	6	3.3	20-24	11-14	III
	6	2.2	5	2.8	15-19	8-11	IV
201 to 250°F **96° to 120°C**	6	4.4	8	4.4	30-50	16-28	I
	6	3.9	7	3.9	25-29	14-16	II
	6	3.3	6	3.3	20-24	11-14	III
	6	2.8	6	2.8	15-19	8-11	IV
251 to 302°F **121.7° to 148.9°C**	7	3.9	8	4.4	30-50	16-28	I
	7	3.9	7	3.9	30-50	16-28	II
	7	3.9	7	3.9	20-29	11-16	III
	6	3.3	7	3.9	15-19	8-11	IV

*Grouped according to level of accuracy required. Group I with greatest latitude is less expensive than Group II, etc.
Please consult factory for temperature ranges, tolerances and differentials not noted. The operating temperature ranges include tolerances.
The ± tolerances shown have been established after careful review of many thermostat applications. Attempts should be made to establish the widest acceptable tolerance possible. For example, the chart may list a tolerance of ±5°F (±2.8°C); however, ±6°F (±3.3°C) may be acceptable for the application at reduced cost.
Note: Temperature checking methods may be slightly different, and allowance for a 1.8°F (1°C) variance should be considered.
See Section B of the Terminal and Bracket Guide for dimensional characteristics.

Operating Parameters

Dielectric Strength	Mil-STD-202 Method 301 -2000 VAC 60 Hz - Terminal to Case
Insulation Resistance	Mil-STD-202 Method 302 Cond. B - 500 Megohms - 500 Volts DC applied
Environmental Exposure	0° to 350°F (–18° to 177°C)
Operating Temp. Range	32° to 302°F (0° to 150°C)
Contact Resistance	Mil-STD-202, Method 307 - 50 Milliohms
Marking	Mil-STD-1285
Weight	6 Grams (Brackets and wire leads not included)
Materials	Base: Phelonic Terminals: Plated Brass or Steel Closure: Aluminum, Stainless Steel, or Brass Brackets: Aluminum, Stainless Steel, or Brass Contacts: Silver

UL and CSA Listings

UL and CSA Listings are for use in equipment where the acceptability of the combination of the thermostat and equipment is determined by Underwriters' Laboratories, Inc. and/or the Canadian Standards Association.

UL File E36103, UL File SA4469 (3455RBV only), UL File MH8267 (3455R only), CSA File 21048.

F61 SERIES FLOW SWITCH

STANDARD FLOW RATE — SPDT

The F61 flow switch is designed for use on liquid lines using water, ethylene glycol solutions, or other liquids not injurious to the brass and phosphor bronze parts that come in contact with the liquid. The SPDT contacts make or break an electrical circuit when flow starts or stops.

F61KB-11: NEMA 1 type enclosure.

F61MB-1: This flow switch meets NEMA type 4 requirements and is UL listed as raintight. Use on indoor or outdoor applications in high humidity atmospheres, on liquid lines handling fluids below dewpoint or below 32°F (0°C).

Use on lines carrying well water, swimming pool water, sea water, brine or ethylene glycol. Not for use with hazardous fluids or in hazardous atmospheres.

The bronze paddle is of three segments for use in pipes from 1 in. to 3 in. diameter. Paddle segments may be removed or trimmed as needed. Catalog No. F61KB-11 and F61MB-1 include a 6 in. paddle for pipes 4 in. to 6 in.

Pipe Connection: 1 in. NPT.

Max Liquid Pressure: 150 PSIG (1034 kPa).

Max Liquid Temperature: 250°F (121°C).

Min Liquid Temperature, F61KB-11: 32°F (0°C)

F61MB-1: -20°F (-29°C).

Dimensions:
F61KB-11: 8⅜ in. H (3 in. paddle), 4 in. W, 2 13/16 in. D.

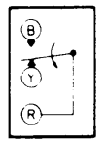
F61MB-1: 8 11/16 in. H (3 in. paddle), 4 51/64 in. W, 2 13/16 in. D.

TO ORDER: Specify F61KB-11 for NEMA 1 enclosure, F61MB-1 for NEMA 4 enclosure.

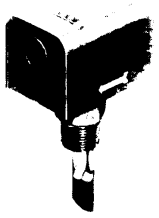
ELECTRICAL RATINGS

Motor Ratings VAC	120	208	240	277
Horsepower	1	1	1	—
AC Full Load amp	16.0	8.8	8.0	—
AC Locked Rotor amp	96.0	52.8	48.0	—
Non-Inductive or Resistance Load amp	16	16	16	16
Pilot Duty — 125 VA, 24/277 VAC				

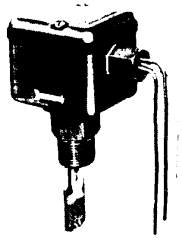
Series F61



ACTION ON INCREASE OF FLOW



F61KB-11
Replaces McDonnell & Miller FS4-3



F61MB-1
Replaces McDonnell & Miller FS8V-12

TYPICAL FLOW RATES — GPM (m³/hr) REQUIRED TO ACTUATE SWITCH

Line Pipe Size in.		1	1¼	1½	2	2½	3	4*	5*	6*	8*
Min Adj	Flow Increase R to Y Closes	4.2 (1.0)	5.8 (1.3)	7.5 (1.7)	13.7 (3.1)	18.0 (4.1)	27.5 (6.2)	65.0 (14.8) 37.0† (8.4)	125.0 (28.4) 57.0† (12.9)	190.0 (43.1) 74.0† (16.8)	375.0 (85.2) 205.0† (46.6)
	Flow Decrease R to B Closes	2.5 (0.6)	3.7 (0.8)	5.0 (1.1)	9.5 (2.2)	12.5 (2.8)	19.0 (4.3)	50.0 (11.4) 27.0† (6.1)	101.0 (22.9) 41.0† (9.3)	158.0 (35.9) 54.0† (12.3)	320.0 (72.7) 170.0† (38.6)
Max Adj	Flow Increase R to Y Closes	8.8 (2.0)	13.3 (3.0)	19.2 (4.4)	29.0 (6.6)	34.5 (7.8)	53.0 (12.0)	128.0 (29.1) 81.0† (13.4)	245.0 (55.6) 118.0† (26.8)	375.0 (85.2) 144.0† (32.7)	760.0 (172.6) 415.0† (94.2)
	Flow Decrease R to B Closes	8.5 (1.9)	12.5 (2.8)	18.0 (4.1)	27.0 (6.1)	32.0 (7.3)	50.0 (11.4)	122.0 (27.7) 76.0† (17.3)	235.0 (53.4) 111.0† (25.2)	360.0 (81.8) 135.0† (30.7)	730.0 (165.8) 400.0† (90.8)

* Flow rates for these sizes are calculated.
† These GPM figures are for switch with 6 in. paddle. For 4 in. and 5 in. line pipe the paddle is trimmed.

LOW FLOW RATE — SPDT

For use on liquid lines using water, ethylene glycol solutions, or other liquids not injurious to the brass and phosphor bronze parts. SPDT contact switch is activated by a low flow rate; however, it has a large flow capacity with minimum pressure drop. Typical applications include:

— Water purification and treatment systems.
— Booster pumps.
— Fast shut down on high input boilers to guard against circulation failure.
— Cooling systems for electronic tubes, bearings and compressors.

F61KD: NEMA 1 type enclosure.

F61MD: NEMA 4 (vaportight) enclosure.

Min Liquid Temperature, F61KD: 32°F (0°C)

F61MD: -20°F (-29°C).

Dimensions: 5 1/32 in. H, 4 in. W, 2 13/16 in. D.

TO ORDER: Specify Catalog Number only.

ELECTRICAL RATINGS

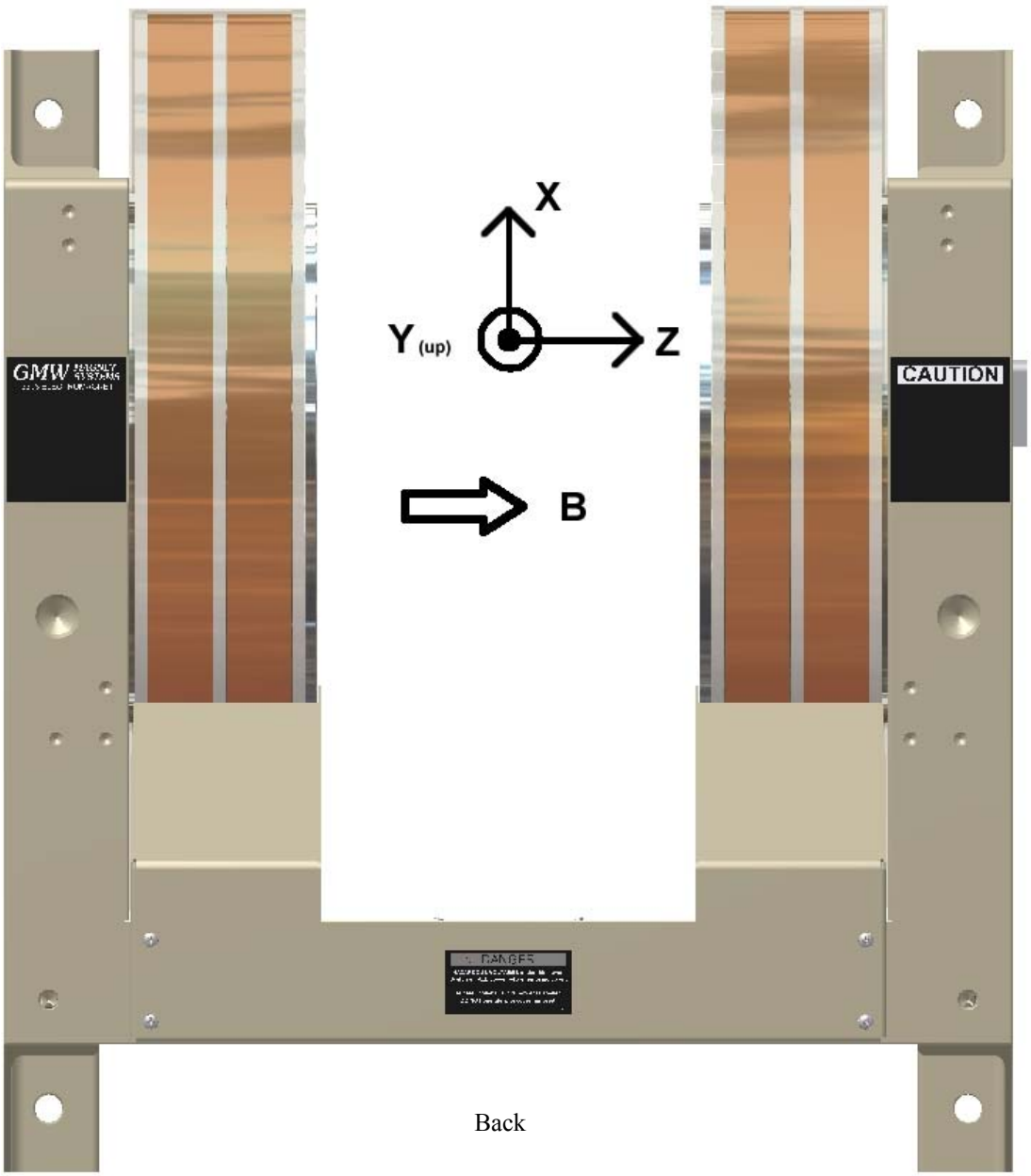
Motor Ratings VAC	120	208	240	277
Horsepower	1	1	1	—
AC Full Load amp	16.0	8.8	8.0	—
AC Locked Rotor amp	96.0	52.8	48.0	—
Non-Inductive or Resistance Load amp	16	16	16	16
Pilot Duty — 125 VA, 24/277 VAC				

F61KD

	Catalog Number	Inlet and Outlet Size Female NPT	Enclosure NEMA Type	Adjustment Range — GPM (m³/hr) R to Y Closes Flow Increase	Adjustment Range — GPM (m³/hr) R to Y Opens Flow Decrease	Maximum Liquid Temp °F (°C)	Maximum Liquid Pressure PSIG (kPa)	Ship wt lb
	F61KD-3	½ in. × ½ in.	1	Minimum .6 (0.14) Maximum 1.1 (0.25)	Minimum .3 (0.07) Maximum 0.9 (0.2)	250 (121)	150 (1034)	2.2
	F61KD-4	¾ in. × ¾ in.	1					
★	F61MD-2	¾ in. × ¾ in.	4					

★ **Non-Stock Item. Built to Order.**

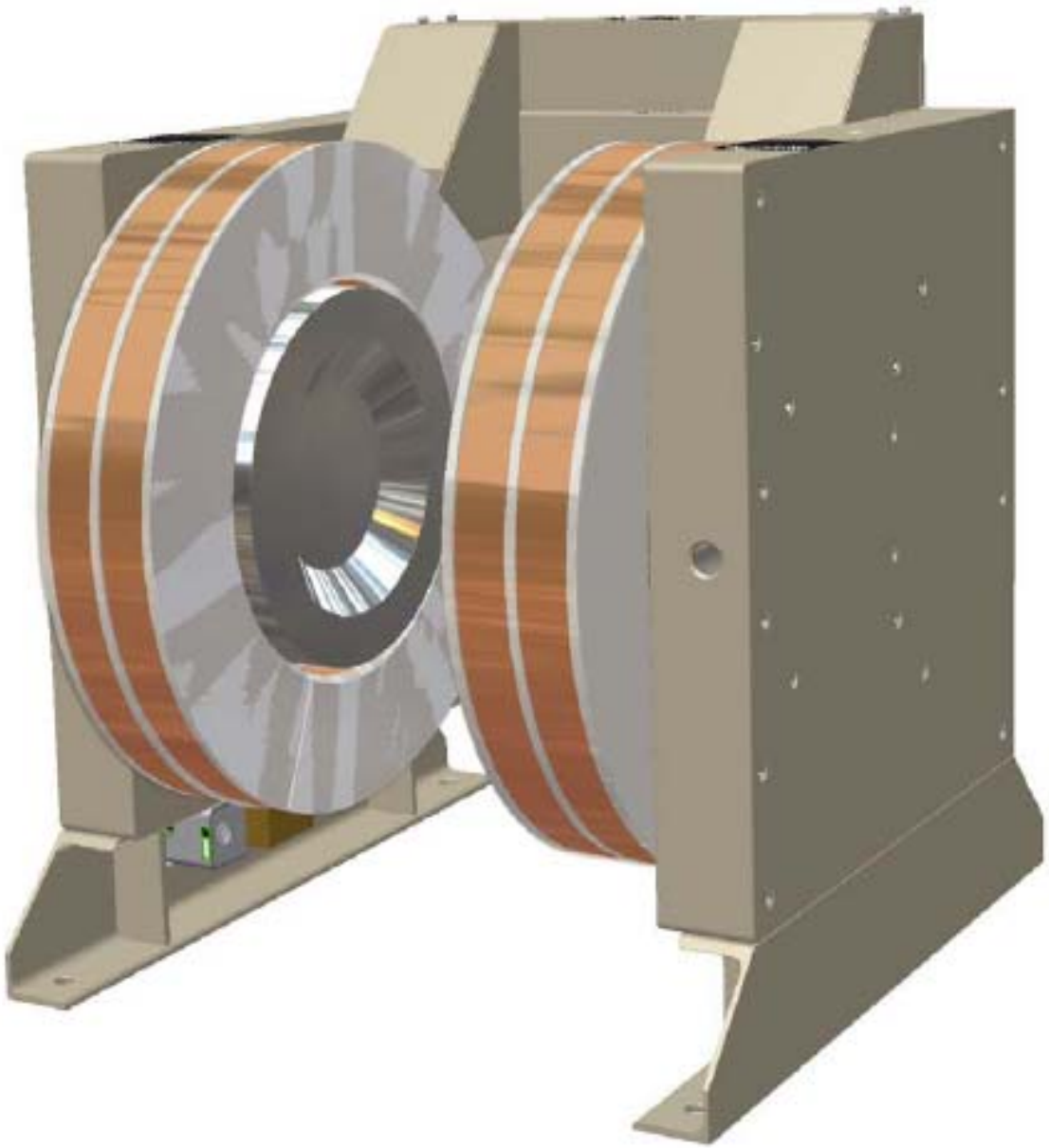
Front



Back

Model 5503 Electromagnet from top view. Showing B direction and mapping axes.

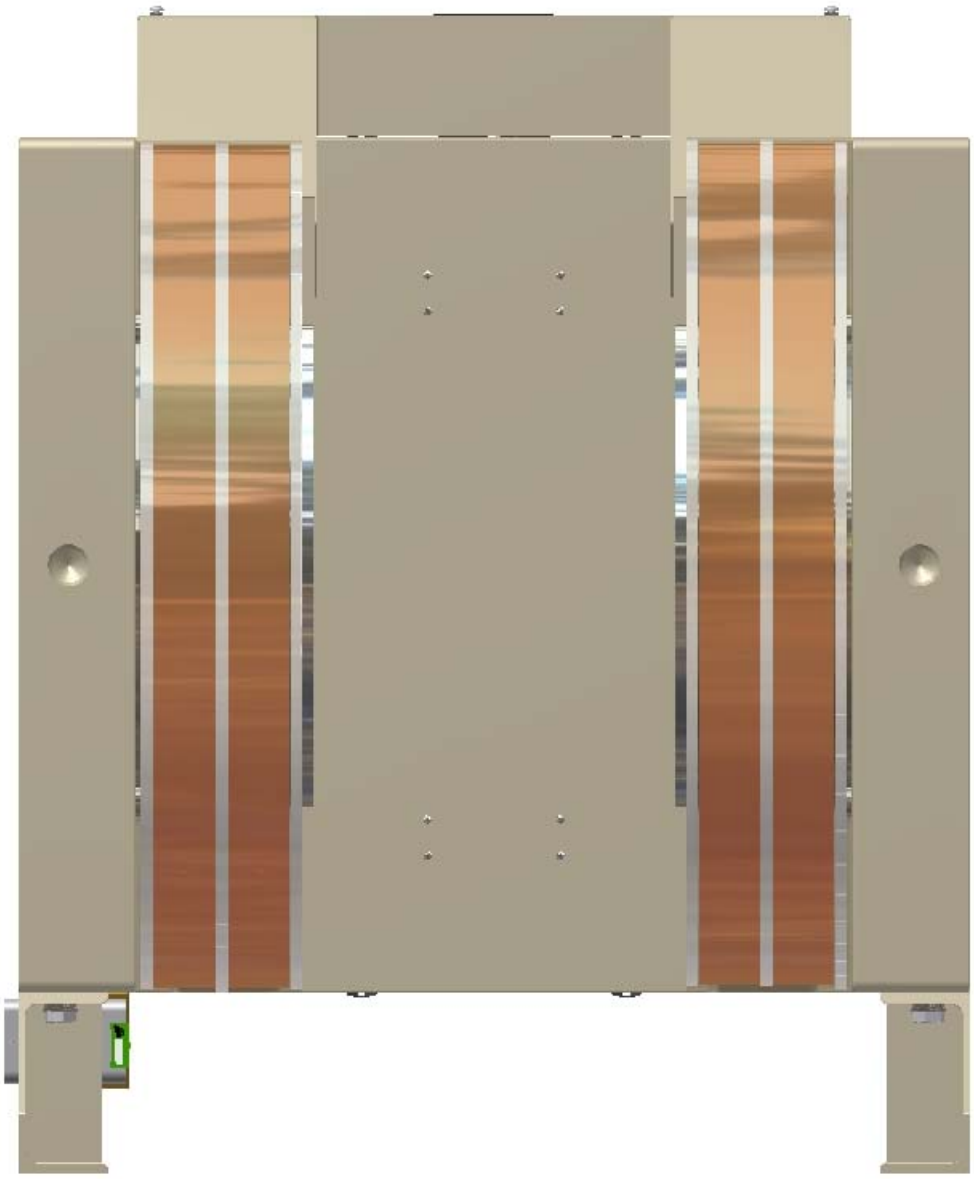
Top



Model 5503 Electromagnet, isometric perspective from front view. Electromagnet shown on Horizontal Mounting Kit.

Top

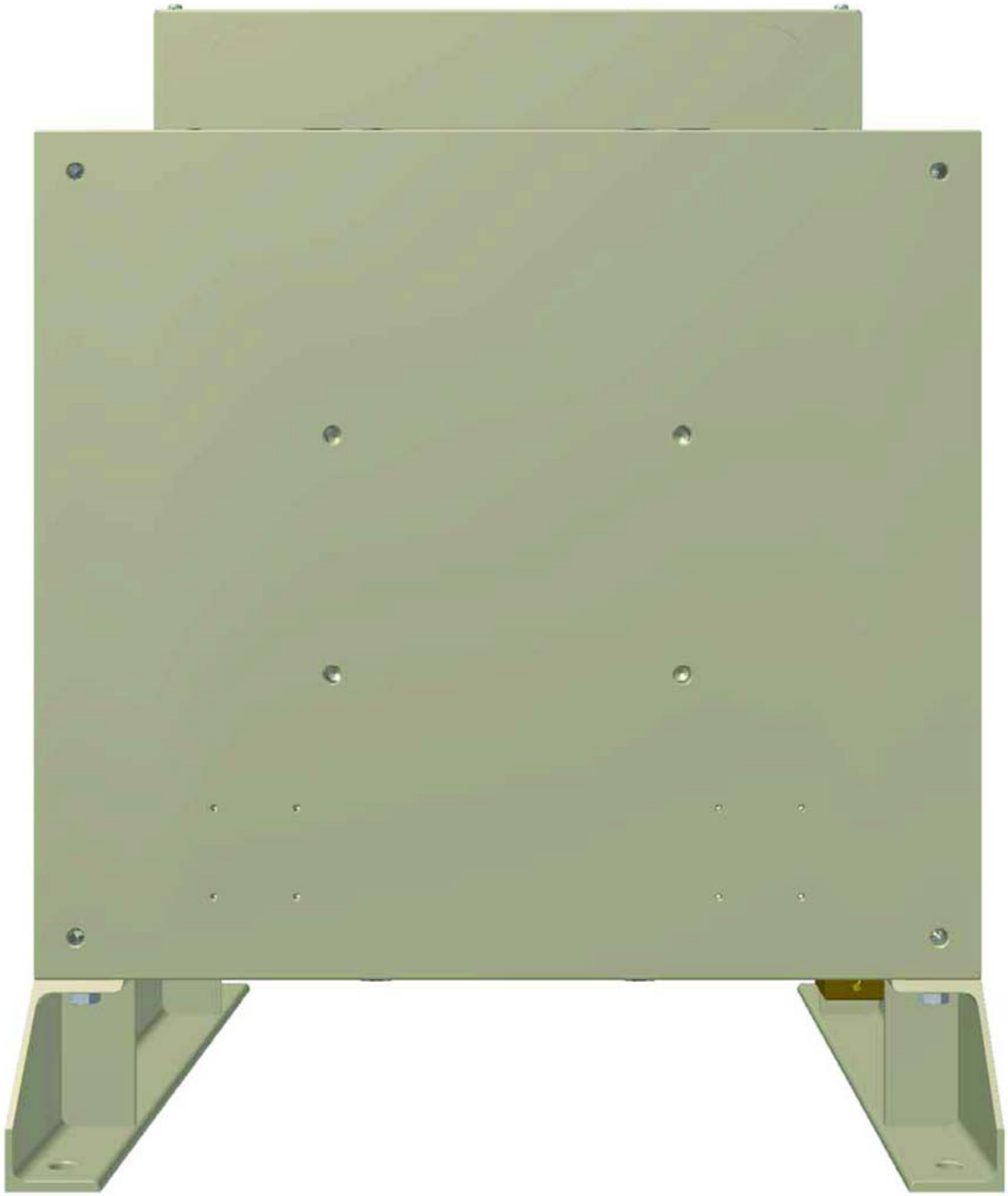
Electrical connections under cover



Model 5503 Electromagnet, from front view. Electromagnet shown on Horizontal Mounting Kit. The electrical terminations cover is at the top.

Top

Electrical connections under cover



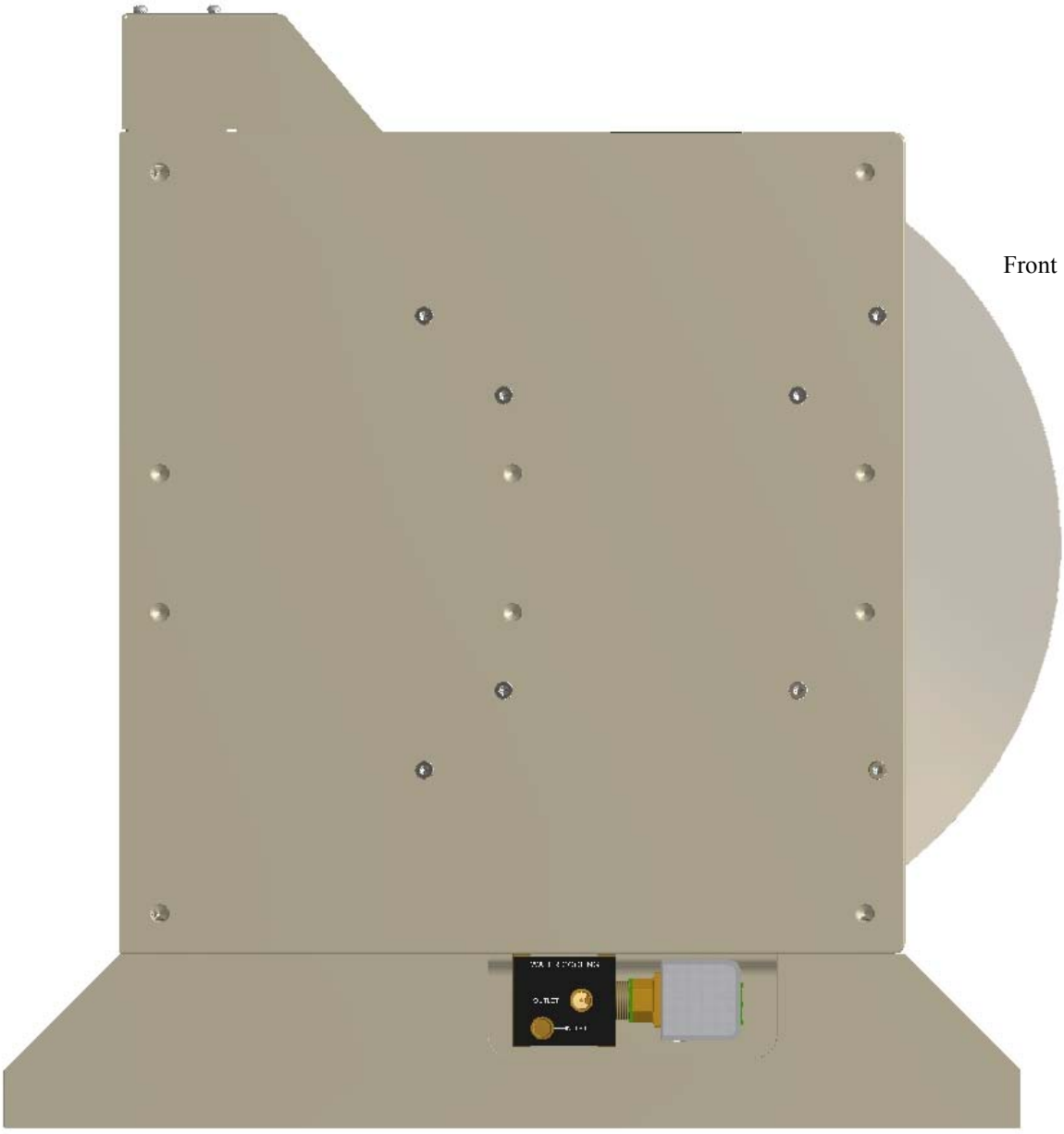
Model 5503 Electromagnet from back view. The electrical connections are made under the cover to the top of the view. The Horizontal Mounting Kit brackets are on the bottom of the Electromagnet.

Top

Electrical connections under cover

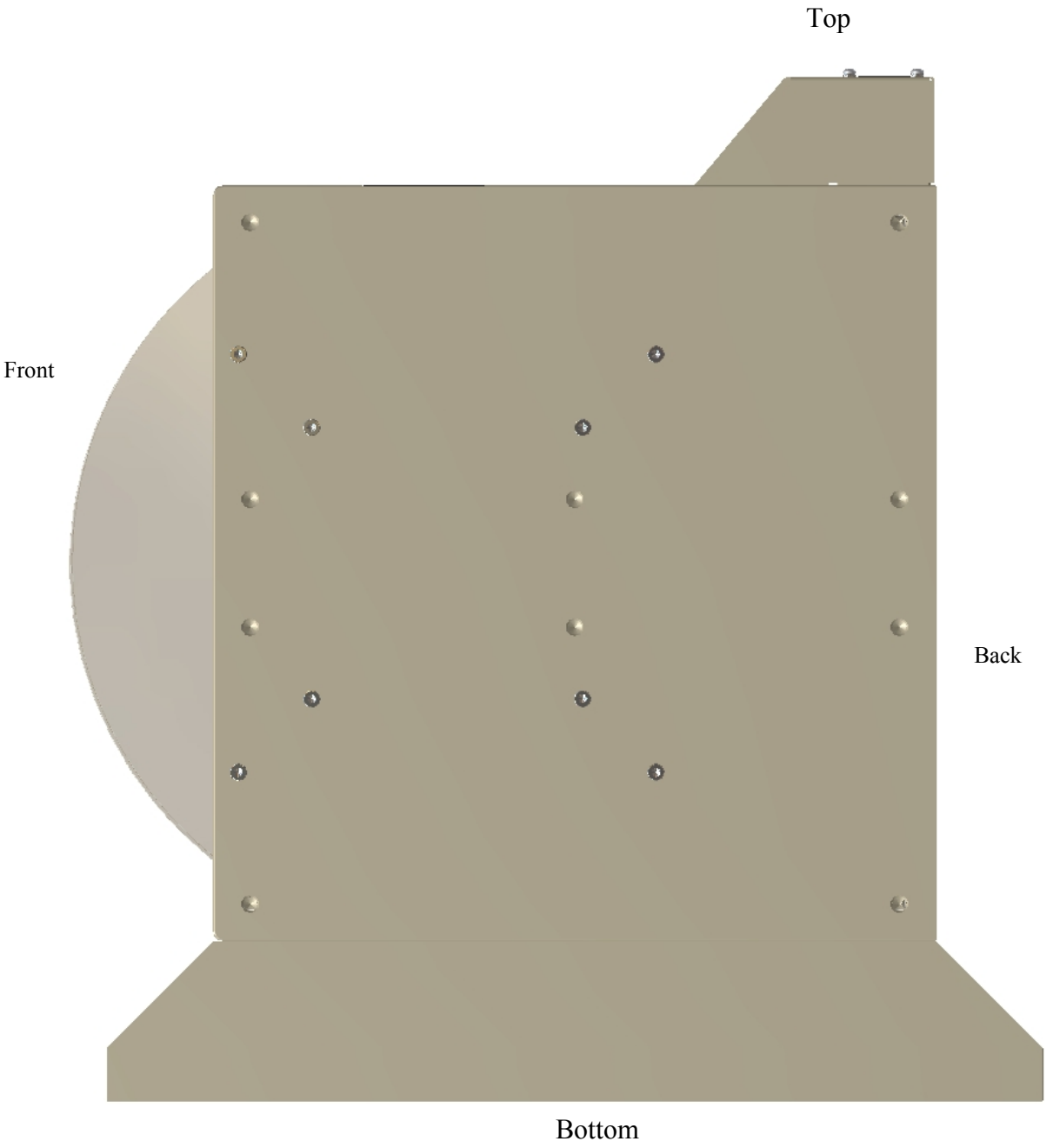
Front

Back



Bottom

Model 5503 Electromagnet. Side view 1. The water connections and Flow Switch are at the bottom.



Model 5503 Electromagnet. Side 2 view

PROPRIETARY
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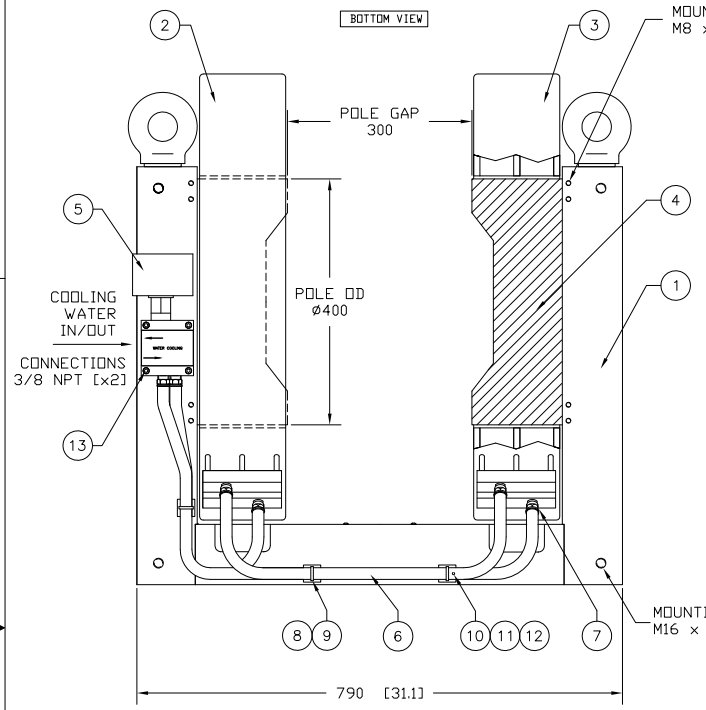
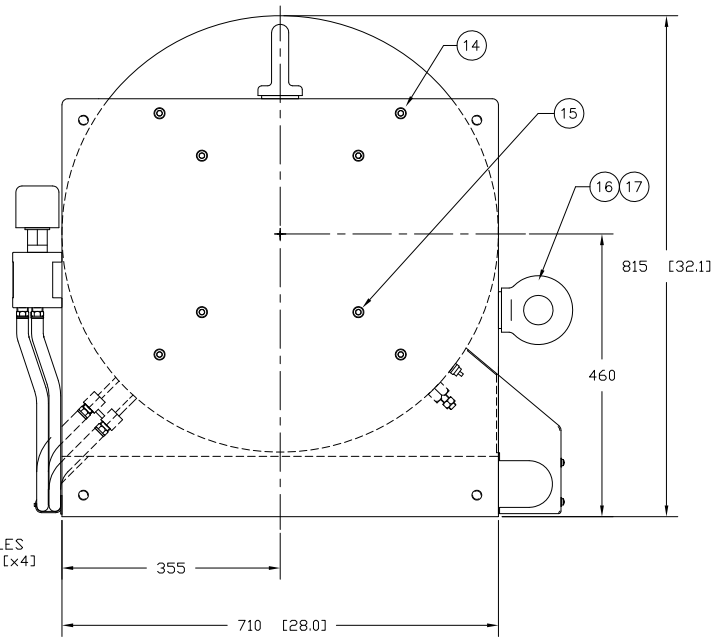
BOTTOM VIEW



SIDE VIEW



REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		05/18/07	G.DOUGLAS
B	MAGNET WATER SPECIFICATIONS CHANGED		08/14/07	G.DOUGLAS
C	ADD PARTS 71 & 72 TO SHEET 2		08/27/07	G.DOUGLAS

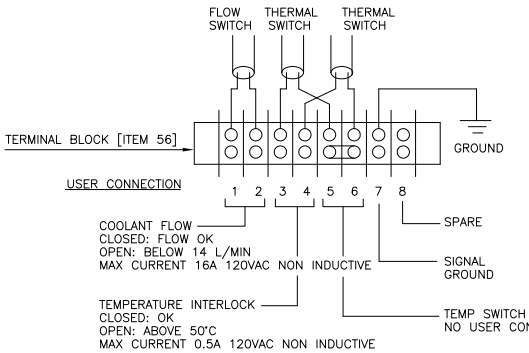
MAGNET SPECIFICATIONS

FIELD (@ XYZ=0)	0.3 T
POLE DIAMETER:	400 mm
POLE GAP:	300 mm
SHIM RING:	290 mm ID, 200 ID, 35 DEEP
COILS	[series connected]
20°C RESISTANCE	0.49 ohm
MAX RESISTANCE	0.59 ohm
MAX POWER [air]	40A/24V (0.9kW)
MAX POWER [water]	140A/82V (11.5kW)
COOLING:	16 liter/min [4 US gpm] 2.8 bar (42 psid)
THERMAL INTERLOCK:	CLOSED CIRCUIT BELOW 50° C
FLOW INTERLOCK:	OPEN CIRCUIT BELOW 14 liter/min
MASS:	1790 kg [3956 lb]

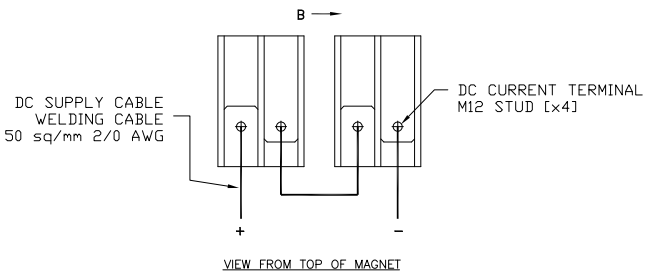
NOTE:

1. PART LIST ITEMS MARKED NOTE 1 APPEAR ON SHEET 1 & SHEET 2 OF THIS DRAWING. PART LIST ITEMS NO 1–49 ARE LISTED ON SHEET 1, PART LIST ITEMS NO 50–99 LISTED ON SHEET 2 .
2. REFER TO SHEET 2 OF THIS DRAWING FOR OTHER VIEWS OF THIS MAGNET
3. FULL POWER TEST TO BE DONE AS SPECIFIED ON BSL TD 88800040.

INTERLOCK SCHEMATIC



DC CURRENT CONNECTIONS



VIEW FROM TOP OF MAGNET

NOTE: DO NOT EXCEED THE MAXIMUM COIL RESISTANCE OR COIL OVERHEATING AND DAMAGE MAY OCCUR

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
17	4		WASHER, FLAT ø34 ID ø60 OD S/S	
16	4		M33 LIFTING EYE	
15	8	DIN 912	SHCS, M10 X 100 S/S	
14	8	DIN 912	SHCS, M10 X 90 S/S	
13	4	DIN 912	SHCS, M6 X 80 S/S	
12	8	BN 737	WASHER, M4 X 8 X 0.5 FLAT S/S	1
11	8	DIN 6797	WASHER, M4 X 0.7 INT LOCK, S/S	1
10	8	DIN 7985A	SCREW, M4 X 8 PAN S/S	1
9	4		CABLE TIE 5mm WIDE T & B	1
8	4	MB4A	MOUNTING PAD TYTON	1
7	6	30182-6-8	P-ON COUPLING 1/2" HOSE 3/8NPT,PARKER	
6	A/R	PB-8-BK	HOSE, RUBBER COVERED 1/2" I.D SWAGELOK	
5	1	11901360	WATER MANIFOLD ASSEMBLY INLET/OUTLET	
4	2	17907-0123-0	POLE [With Shim Ring]	
3	1	11907-0077-0	COIL ASSEMBLY [LH]	
2	1	11907-0078-0	COIL ASSEMBLY [RH]	
1	1	11907-0079-0	YOKE ASSEMBLY	

PARTS LIST

DRAWN G.DOUGLAS 05/03/07
CHECK
ENGINEERING
NEXT ASSY
SYSTEM
SOFTWARE AUTOCAD 2000

DO NOT SCALE FROM DRAWING
DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)

LINEAR	INCHES	mm
X.XXX	±.005	±0.03
X.XX	±.01	±0.1
X.X	±.03	±0.3
X	±.06	±1
DEG.	±.5	±0.5
FINISH	63	1.6

THIRD ANGLE PROJECTION

GMW
955 Industrial Rd, San Carlos, CA 94070
Tel: (650)802-8292. Fax: (650)802-8298.

TITLE
MAGNET ASSEMBLY
MODEL: 5503

SIZE A1 | DRAWING NO. 11907-0076-0 | REV C

SCALE 1:4 | WT kg | SHEET 1 OF 2

PROPRIETARY
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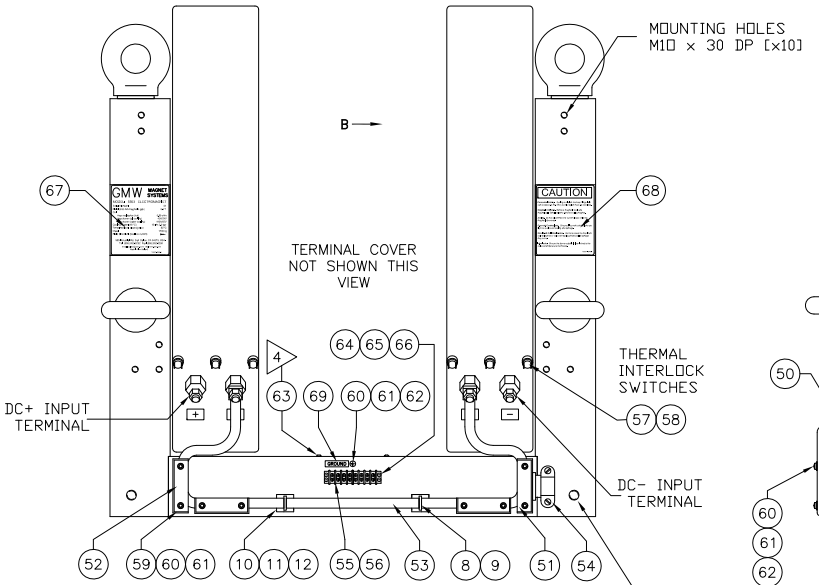
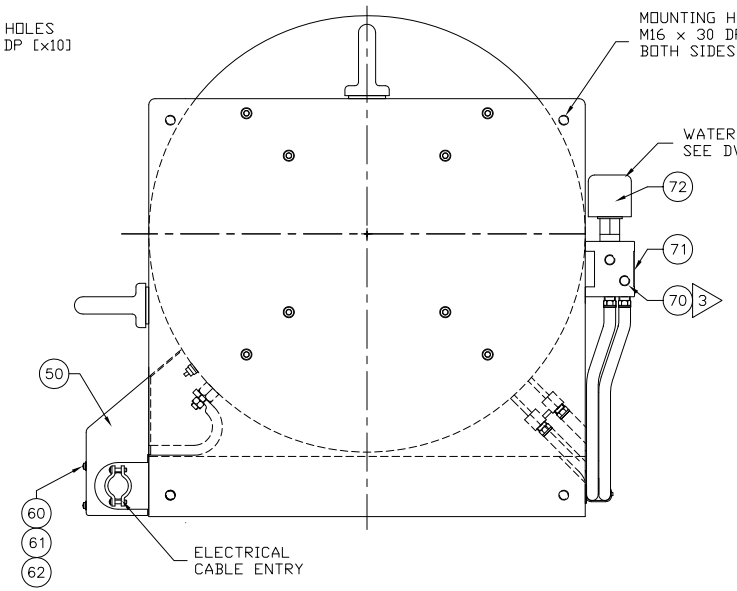
REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		05/18/07	G.DOUGLAS
B	MAGNET WATER SPECIFICATIONS CHANGED		08/14/07	G.DOUGLAS
C	ADD PARTS 71 & 72		08/27/07	G.DOUGLAS

TOP VIEW

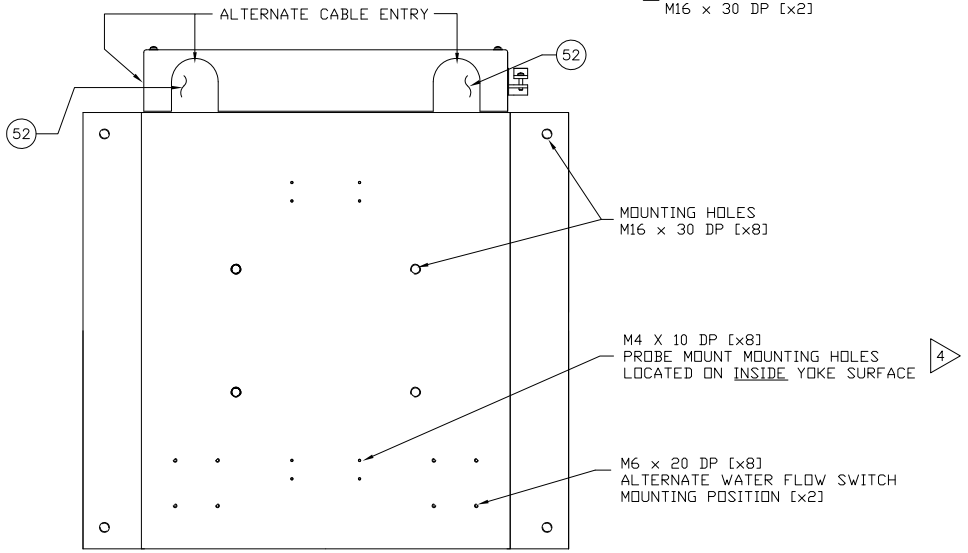


SIDE VIEW



NOTE:

1. PART LIST ITEM NO 1–49 LISTED ON SHEET 1, PART LIST ITEM NO 50–99 LISTED ON SHEET 2.
2. REFER TO SHEET 1 OF THIS DRAWING FOR OTHER VIEWS OF THIS MAGNET.
3. AFTER FINAL TEST IS COMPLETE BLOW WATER OUT OF COOLING CIRCUITS AND SEAL I/O MANIFOLD WITH ITEM 70.
4. A MAGNETIC PROBE MOUNT AND PROBE CAN BE MOUNTED ON THE INSIDE SURFACE OF THE YOKE. CONSULT GMW FOR FURTHER DETAILS.



WATER MANIFOLD/HOSES NOT SHOWN THIS VIEW

BACK VIEW

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
72	1	F61KB–11C	FLOW SWITCH, JOHNSTON CONTROLS	
71	1	10900370	LABEL, WATER CONNECTIONS	
70	2	CP6	PLASTIC SEALING PLUGS, KELVINDALE	3
69	1	10900720	LABEL, GROUND [Fitted under Cover]	
68	1	10907–0045–0	LABEL, CAUTION [RH Side]	
67	1	10907–0044–0	LABEL, SPECIFICATION [LH side]	
66	4	BN 737	WASHER, M3 X 6 X 0.5 FLAT S/S	
65	4	DIN 6797	WASHER, M3 X 0.4 INT LOCK, S/S	
64	4	DIN 7985A	SCREW, M3 X 16 PAN S/S	
63	8	ISO 7380	SHCS, M4 X 8 BUTTON HD S/S.	
62	13	DIN 1780	WASHER, M6 X 1.6 SPRING LOCK, S/S	
61	13	BN 737	WASHER, M6 X 16 X 1.6 FLAT S/S	
60	5	DIN 7985A	SCREW, M6 X 12 PAN S/S	
59	8	DIN 933	SCREW, M6 X 12 HEX HD, S/S	
58	6		WASHER, M5 X 15 X 3, NEOPRENE	
57	6	3450G611.1L500	TEMPERATURE SENSOR, 50°C ELMWOOD	
56	1	MS 8–140	MARKER STRIP, CINCH	
55	1	8–140	TERMINAL BLOCK, CINCH	
54	1	3307	CABLE CLAMP T & B	
53	1	16907–0032–0	CABLE [HIGH CURRENT]	
52	3	17907–0128–2	TERMINAL COVER BRACKET [Without Hole]	
51	1	17907–0128–1	TERMINAL COVER BRACKET [With Hole]	
50	1	11907–0080–0	TERMINAL COVER ASSEMBLY	

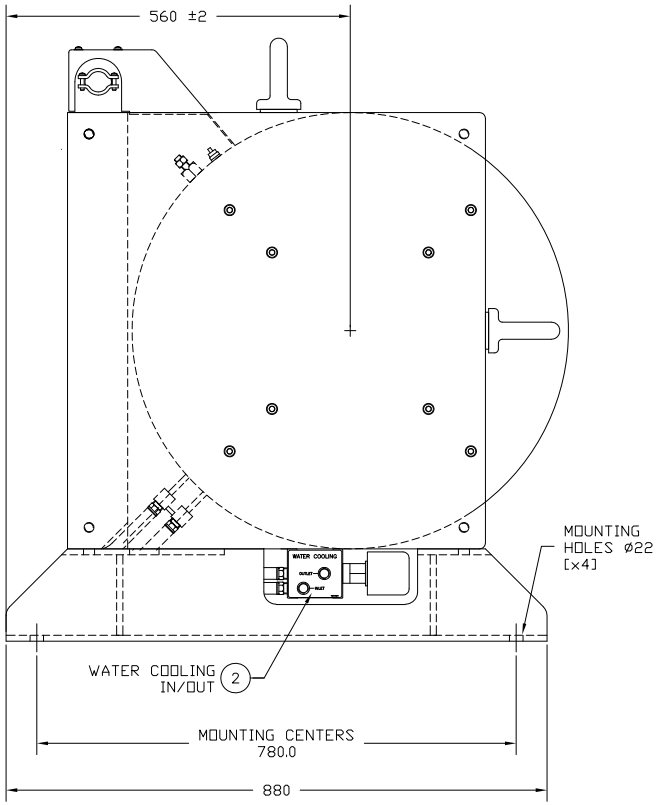
PARTS LIST

DRAWN G.DOUGLAS	DATE 05/03/07	DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)	GMW 955 Industrial Rd, San Carlos, CA 94070 Tel: (650)802–8292. Fax: (650)802–8298.
CHECK	DATE		
ENGINEERING	DATE		
		LINEAR INCHES: X.XXX ±.005, X.XX ±.01, X.X ±.03, X ±.06 / mm: ±0.03, ±0.1, ±0.3, ±1	TITLE: MAGNET ASSEMBLY MODEL: 5503
		DEG. ±.5 / ±0.5	
	B5330	FINISH 63 / 1.6	SIZE A1 / DRAWING NO. 11907–0076–0 / REV C
NEXT ASSY	SYSTEM	THIRD ANGLE PROJECTION	
SOFTWARE AUTOCAD 2000			SCALE 1:4 / WT kg / SHEET 2 OF 2

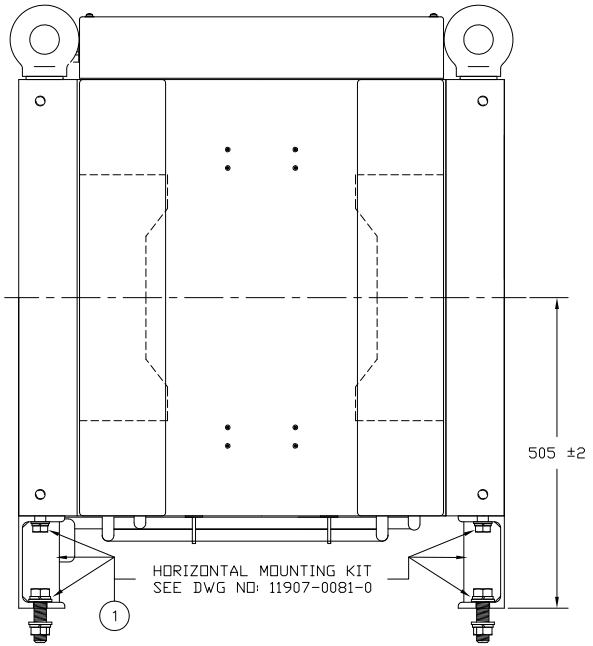
PROPRIETARY
THIS DRAWING CONTAINS CONFIDENTIAL INFORMATION PROPRIETARY TO GMW INC. IT MUST NOT BE REPRODUCED OR DISCLOSED TO OTHERS OR USED IN ANY OTHER WAY, IN WHOLE OR IN PART EXCEPT AS AUTHORIZED IN WRITING BY GMW INC.

REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		05/18/07	G.DOUGLAS
B	CHG DIM @ C3, ADD OTHER DIMS		08/14/07	G.DOUGLAS

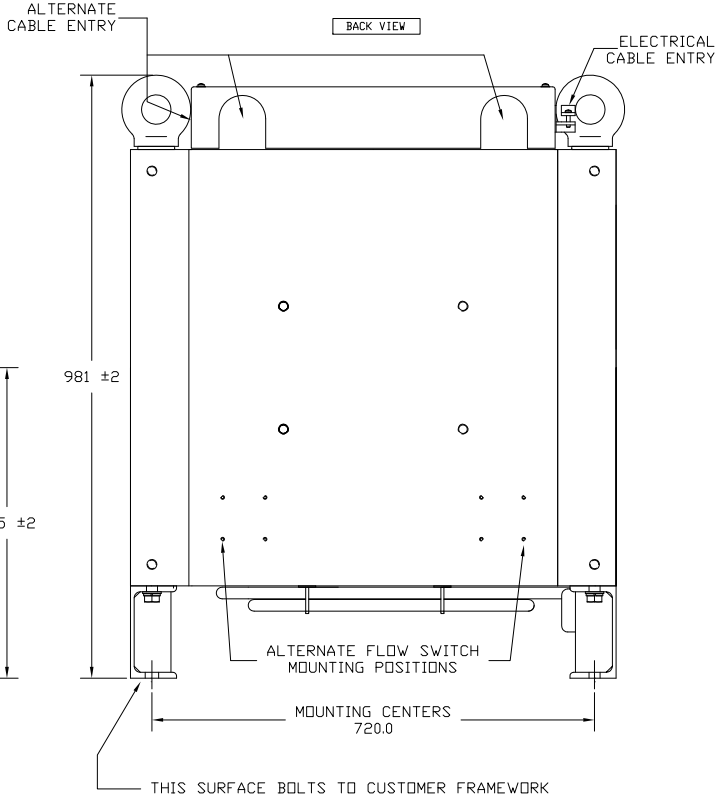
SIDE VIEW

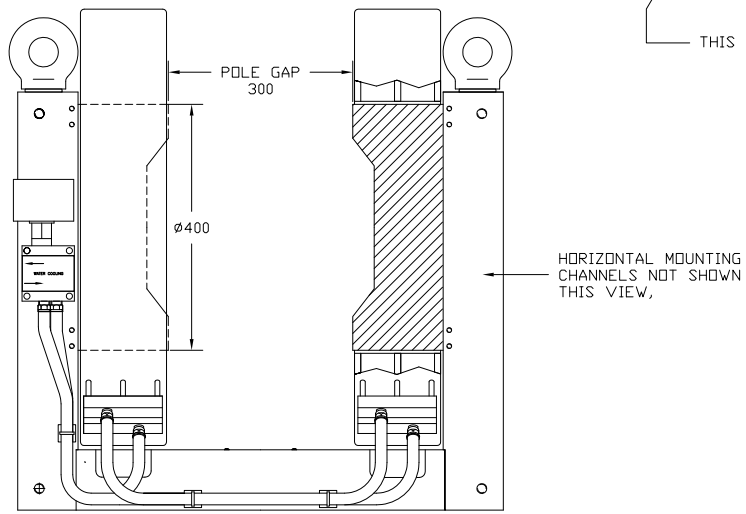


FRONT VIEW



BACK VIEW





BOTTOM VIEW

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
2	1	10907-0046-0	LABEL, WATER INLET/OUTLET	
1	1	11907-0081-0	HORIZONTAL MOUNTING KIT	

PARTS LIST

DRAWN	G.DOUGLAS 05/18/07
CHECK	DATE
ENGINEERING	DATE
	B5330
NEXT ASSY	SYSTEM
SOFTWARE	AUTOCAD 2000

DO NOT SCALE FROM DRAWING
DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)

LINEAR	INCHES	mm
X.XXX	±.005	±0.03
X.XX	±.01	±0.1
X.X	±.03	±0.3
X	±.06	±1
DEG.	±.5	±0.5
FINISH	63	1.6

THIRD ANGLE PROJECTION

GMW
955 Industrial Rd, San Carlos, CA 94070
Tel: (650)802-8292. Fax: (650)802-8298.

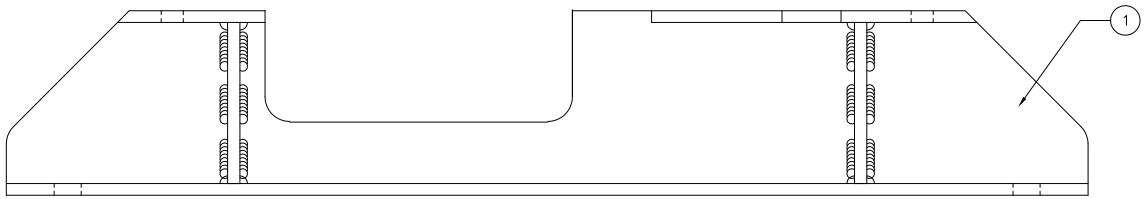
TITLE
MAGNET HORIZONTAL MOUNTED
MODEL: 5503

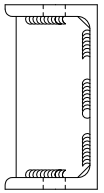
SIZE	DRAWING NO.	REV
A1	11907-0082-0	B

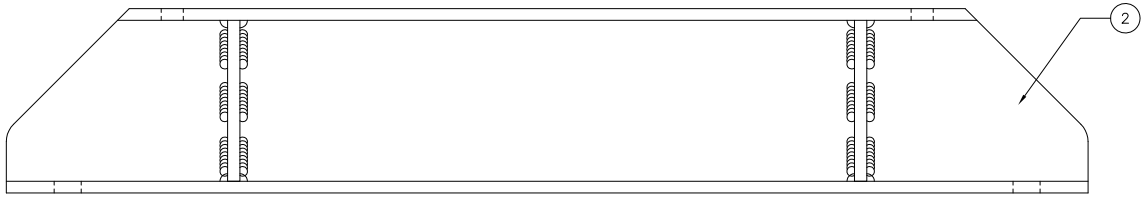
SCALE 1:4 | WT kg | SHEET 1 OF 1

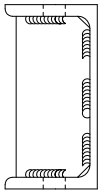
PROPRIETARY
THIS DRAWING CONTAINS CONFIDENTIAL INFORMATION PROPRIETARY TO GMW INC. IT MUST NOT BE REPRODUCED OR DISCLOSED TO OTHERS OR USED IN ANY OTHER WAY, IN WHOLE OR IN PART EXCEPT AS AUTHORIZED IN WRITING BY GMW INC.

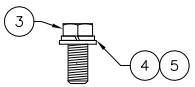
REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		05/18/07	G.DOUGLAS

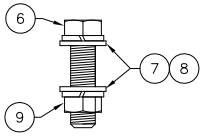












ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
9	4	DIN 934	NUT, M20 HEX HD S/S	
8	8	DIN127B	WASHER, M20 X 34 SPRING LOCK, S/S	
7	8	DIN 125A	WASHER, M20 X 37 X 3 FLAT S/S	
6	4	DIN 933	SCREW, M20 X 50 HEX HD, S/S	
5	4	DIN 127B	WASHER, M16 X 27 SPRING LOCK, S/S	
4	4	DIN 125A	WASHER, M16 X 30 X 3 FLAT S/S	
3	4	DIN 933	SCREW, M16 X 35 HEX HD, S/S	
2	1	17907-0120-2	HORIZONTAL MOUNTING CHANNEL	
1	1	17907-0120-1	HORIZONTAL MOUNTING CHANNEL	

PARTS LIST

DRAWN G.DOUGLAS DATE 05/18/07
CHECK DATE
ENGINEERING DATE
NEXT ASSY SYSTEM
SOFTWARE AUTOCAD 2000

DO NOT SCALE FROM DRAWING
DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)

LINEAR	INCHES	mm
X.XXX	±.005	±0.03
X.XX	±.01	±0.1
X.X	±.03	±0.3
X	±.06	±1
DEG.	±.5	±0.5
FINISH	63	1.6

THIRD ANGLE PROJECTION

GMW
955 Industrial Rd, San Carlos, CA 94070
Tel: (650)802-8292. Fax: (650)802-8298.

TITLE
HORIZONTAL MOUNTING KIT
MODEL: 5503

SIZE	DRAWING NO.	REV
A1	11907-0081-0	A

SCALE 1:2 | WT kg | SHEET 1 OF 1

PROPRIETARY
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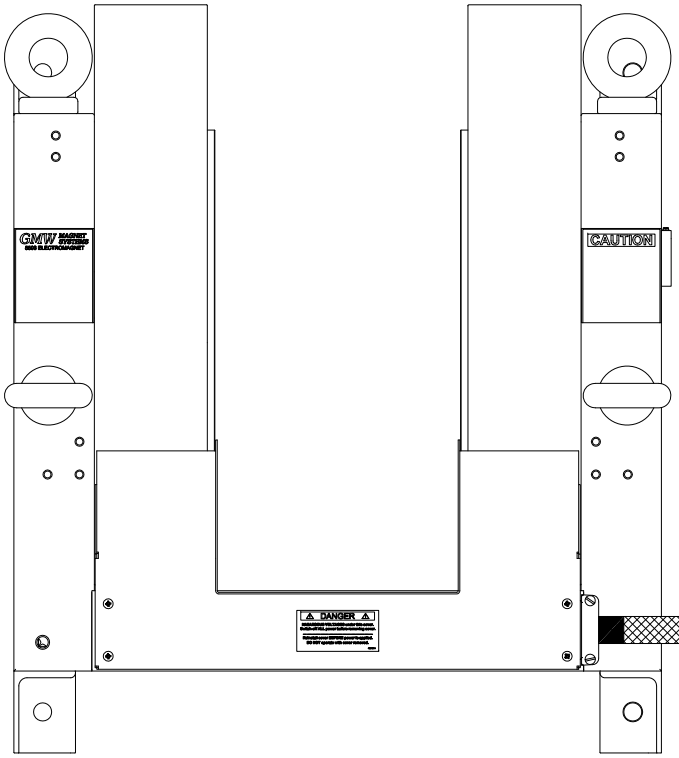
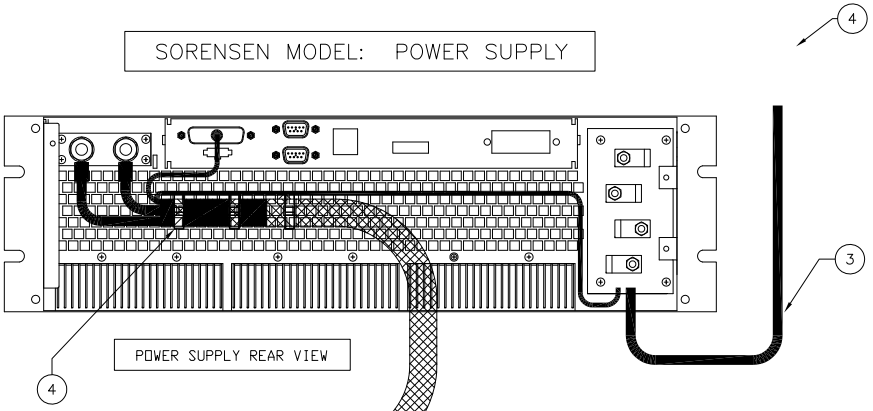
REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE			

MODEL: 5503 ELECTROMAGNET



SORENSEN MODEL: POWER SUPPLY



POWER SUPPLY REAR VIEW

TOP VIEW TERMINAL COVER REMOVED

*** WARNING ***
CHECK AC POWER VOLTAGE AND FREQUENCY MATCH POWER SUPPLY SPECIFIED REQUIREMENTS BEFORE APPLYING AC INPUT POWER

NOTE

1. POWER SUPPLY SHOWN WITH 3 PHASE 208V AC INPUT
2. REFER TO TABLE ON DWG 13907-00060 FOR AC INPUT RATINGS OTHER THAN 3 PHASE 208V
3. MAGNET SHOWN WITH RH CABLE ENTRY. LH, & REAR ENTRY OPTIONAL

N/S = NOT SUPPLIED

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
4	3	10364	CABLE TIE, NYLON 5mm WIDE. BAR-LOK	
3	1	84154351	PLUG 3 PH 100A/250VAC, INTERPOWER	N/S
2	1	4A-0404	CABLE, TYPE SO 4 CORE 4AWG, ANIXTER	N/S
1	1	16900000	CURRENT & INTERLOCK CABLE 160A	

PARTS LIST

DRAWN G.DOUGLAS	DATE 07/02/07	DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)
CHECK	DATE	
ENGINEERING	DATE	
		LINEAR: INCHES X.XXX ±.005, X.XX ±.01, X.X ±.03, X ±.06; mm ±0.03, ±0.1, ±0.3, ±1
		DEG. ±.5 ±0.5
		FINISH 63 1.6
5503		THIRD ANGLE PROJECTION
NEXT ASSY	SYSTEM	
SOFTWARE AUTOCAD 2000		

GMW
955 Industrial Rd, San Carlos, CA 94070
Tel: (650)802-8292. Fax: (650)802-8298.

TITLE
ELECTRIAL ASSEMBLY
5503-SORENSEN SGI

SIZE	DRAWING NO.	REV
A1	11907-0083-0	A

SCALE NTS | WT kg | SHEET 1 OF 1

PROPRIETARY
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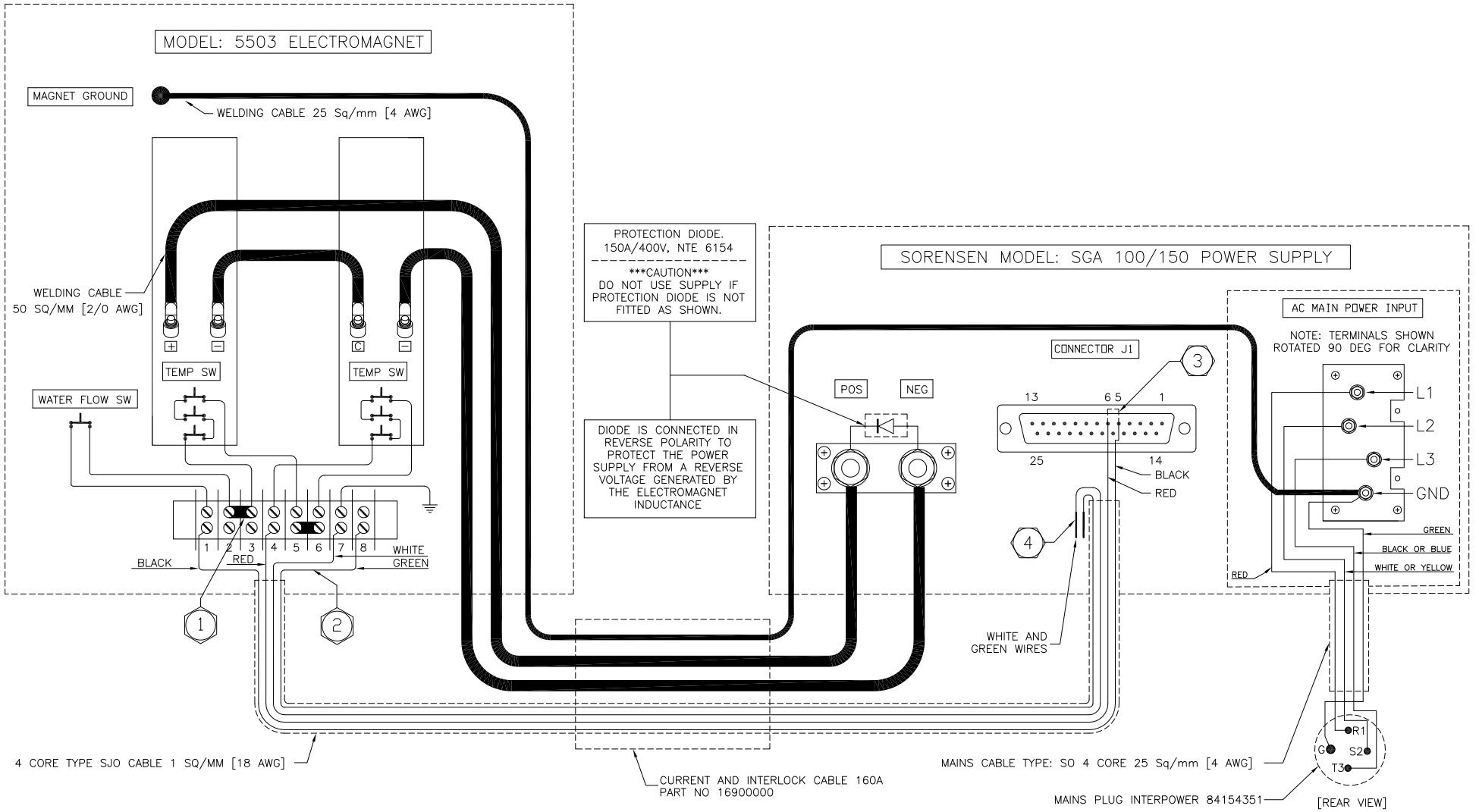
REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		08/14/07	G.DOUGLAS



NOTE:

1. MAGNET WATER FLOW AND TEMP INTERLOCKS LINKED IN SERIES ON MAGNET.
2. WHITE AND GREEN WATER FLOW INTERLOCK WIRES TIED TO TERM 7 & TERM 8.
3. REMOVE LINK BETWEEN PIN 5 & PIN 6 ON POWER SUPPLY AT J1. THEN CONNECT INTERLOCKS WIRES AS SHOWN.
4. INSULATE WHITE AND GREEN WIRES WITH HEAT SHRINK SLEEVING [not used].

ELECTROMAGNET SYSTEM ELECTRICAL REQUIREMENTS			
AC INPUT POWER 3 PHASE, 48 to 62HZ	187–242V	342–440V	396–528V
AC INPUT FULL LOAD CURRENT	62A	40A	39A
RECOMMENDED MAIN AC BREAKER	70A	50A	40A
RECOMMENDED AC POWER OUTLET	100A/250V	50A/440V	–
RECOMMENDED AC CABLE SIZE	20 SQ/MM	16 SQ/MM	16 SQ/MM
NOTE: DRAWING SHOWS POWER SUPPLY FOR US 3 PHASE 208V AC POWER			

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
PARTS LIST				

DRAWN G.DOUGLAS 07/03/07
CHECK
ENGINEERING
DO NOT SCALE FROM DRAWING
DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)

LINEAR	INCHES	mm
X.XXX	±.005	±0.03
X.XX	±.01	±0.1
X.X	±.03	±0.3
X	±.06	±1
DEG.	±.5	±0.5
FINISH	63	1.6

THIRD ANGLE PROJECTION

NEXT ASSY | SYSTEM
SOFTWARE AUTOCAD 2000

GMW
955 Industrial Rd, San Carlos, CA 94070
Tel: (650)802-8292. Fax: (650)802-8298.

TITLE
ELECTRICAL WIRING
5503/SORENSEN SGI

SIZE A1 | DRAWING NO. 13907-0006-0 | REV A
SCALE NTS | WT kg | SHEET 1 OF 1

PROPRIETARY
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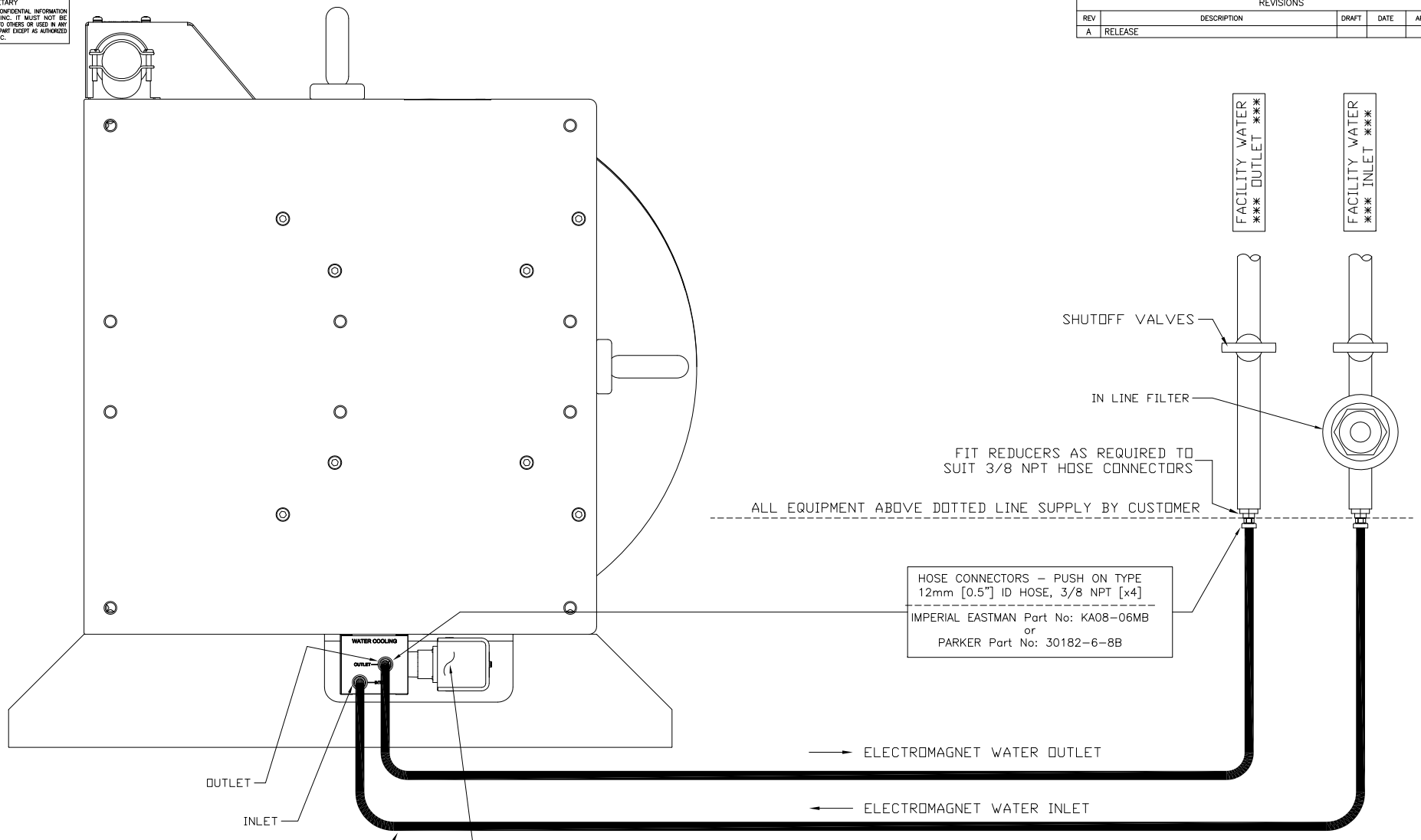
REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE			



COOLING SYSTEM SPECIFICATIONS			
SUBSYSTEM NAME	FLOW RATE (liter/min)	PRESSURE (bar)	TEMPERATURE (deg C)
ELECTROMAGNET	16	2.8	18–25

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
PARTS LIST				

DRAWN G.DOUGAS 07/02/02
CHECK
ENGINEERING
DO NOT SCALE FROM DRAWING
DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)

	LINEAR	INCHES	mm
	X.XXX	±.005	±0.03
	X.XX	±.01	±0.1
	X.X	±.03	±0.3
	X	±.06	±1
	DEG.	±.5	±0.5
	FINISH	63	1.6

NEXT ASSY: 5503
SYSTEM
SOFTWARE AUTOCAD 2000
THIRD ANGLE PROJECTION

GMW
955 Industrial Rd, San Carlos, CA 94070
Tel: (650)802-8292. Fax: (650)802-8298.

TITLE
COOLING SYSTEM
MODEL: 5503

SIZE A1 | DRAWING NO. 11907-0084-0 | REV A
SCALE 1:5 | WT kg | SHEET 1 OF 1

PROPRIETARY
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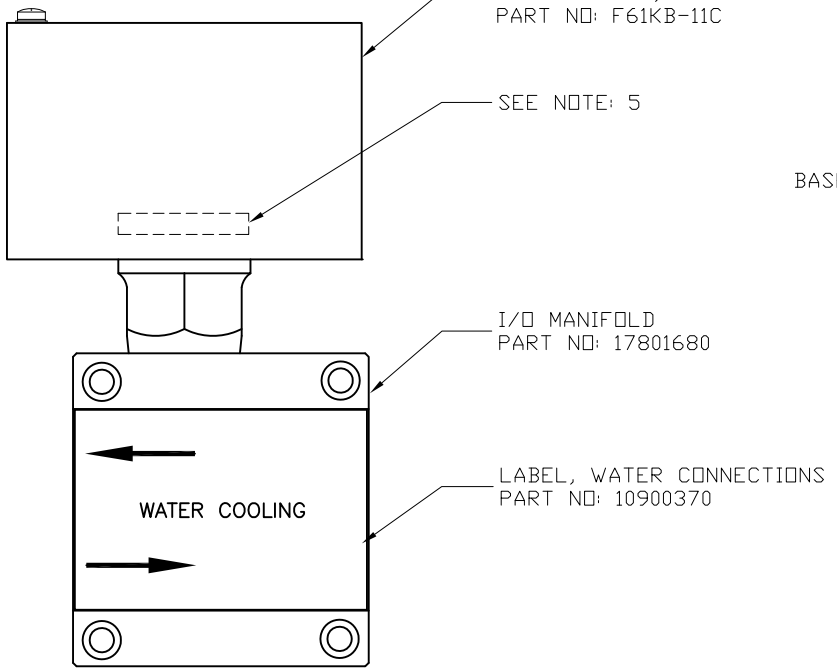
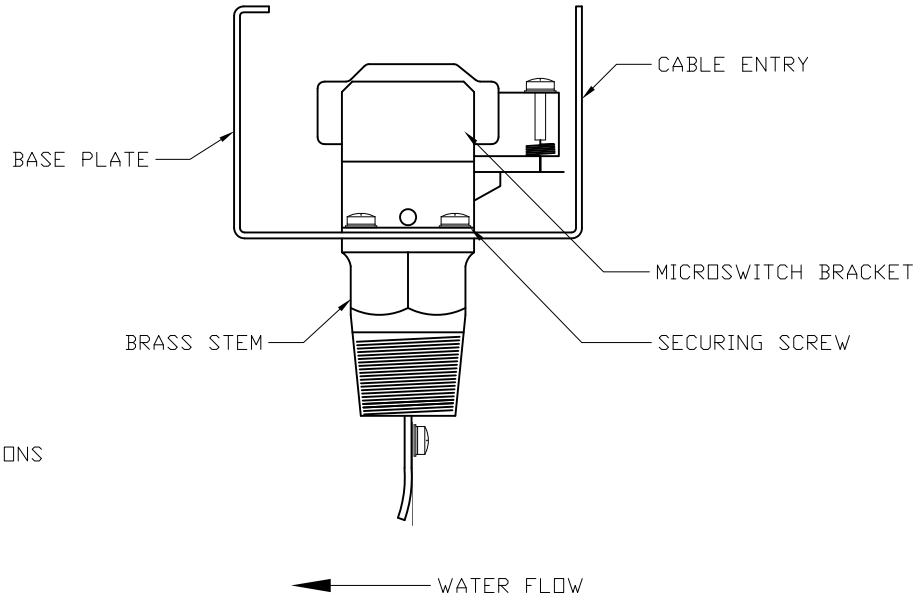
REVISIONS

REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		04/26/99	G.DOUGLAS
B	ADD LABEL PART NUMBER		08/27/07	G.DOUGLAS





INSTRUCTIONS ON MODIFICATION AND FITTING OF FLOW SWITCH

1. REMOVE FLOW SWITCH COVER.
2. REMOVE FOUR SECURING SCREWS AND ROTATE BASE PLATE 180 DEG.
3. REASSEMBLE MICROSWITCH BRACKET AND BASE PLATE ONTO BRASS STEM.
4. APPLY THREAD SEAL TAPE TO BASE STEM THREADED AREA.
5. REMOVE FLOW DIRECTION LABELS FROM FLOW SWITCH COVER (x2).
6. ASSEMBLE FLOW SWITCH ONTO WATER I/O MANIFOLD.
7. FIT COMPLETED FLOW SWITCH/WATER I/O MANIFOLD ASSEMBLY ONTO MAGNET.

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE

PARTS LIST

DRAWN G.DOUGLAS — DATE 04/26/99
CHECK — DATE
ENGINEERING — DATE

11801600 | 3474
NEXT ASSY | SYSTEM

SOFTWARE AUTOCAD 2000

DO NOT SCALE FROM DRAWING
DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)

LINEAR	INCHES	mm
X.XXX	±.005	±0.03
X.XX	±.01	±0.1
X.X	±.03	±0.3
X	±.06	±1
DEG.	±.5	±0.5
FINISH	63	1.6

THIRD ANGLE PROJECTION

GMW
955 Industrial Rd, San Carlos, CA 94070
Tel: (650)802-8292. Fax: (650)802-8298.

TITLE
I/O MANIFOLD ASSEM
MODEL: 3474/5503

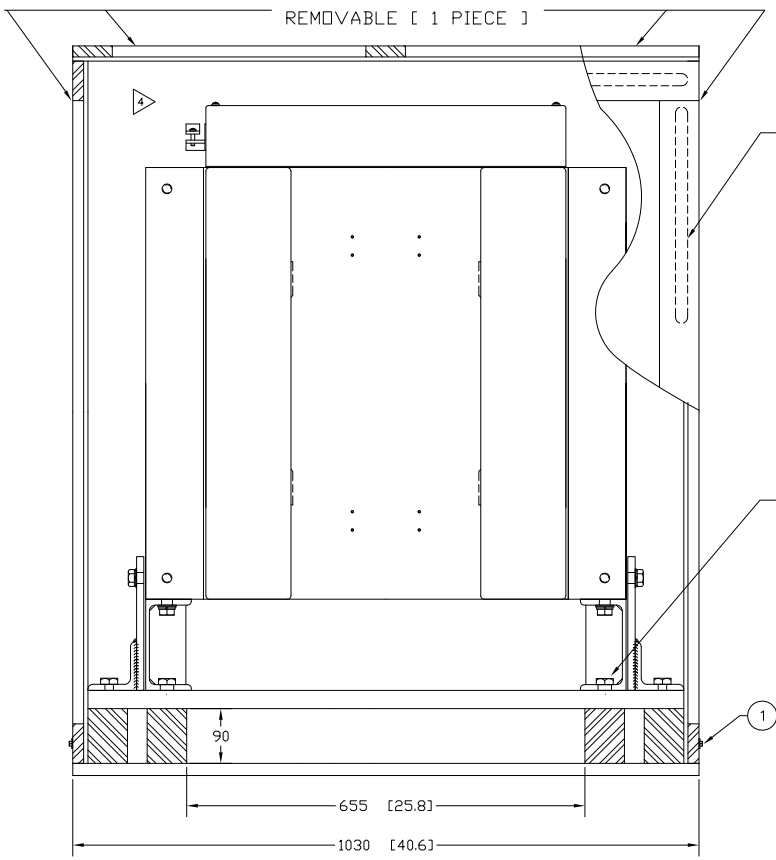
SIZE A2 | DRAWING NO. 11901360 | REV B

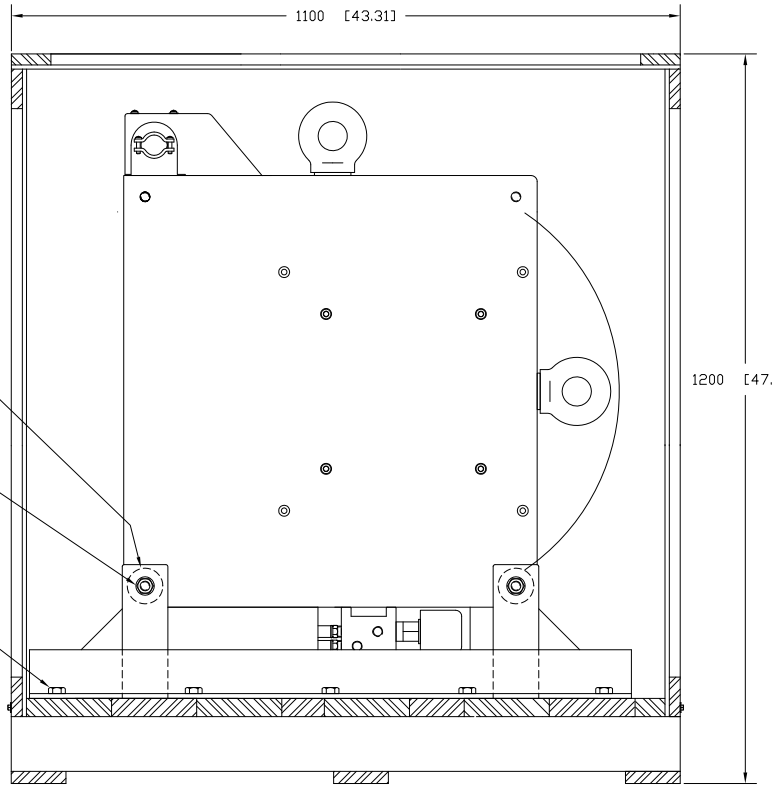
SCALE 1:1 | WT kg | SHEET 1 OF 1

PROPRIETARY
THIS DRAWING CONTAINS CONFIDENTIAL INFORMATION PROPRIETARY TO GMW INC. IT MUST NOT BE REPRODUCED OR DISCLOSED TO OTHERS OR USED IN ANY OTHER WAY, IN WHOLE OR IN PART EXCEPT AS AUTHORIZED IN WRITING BY GMW INC.

REVISIONS				
REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		15/18/07	G.DOUGLAS

TOP COVER





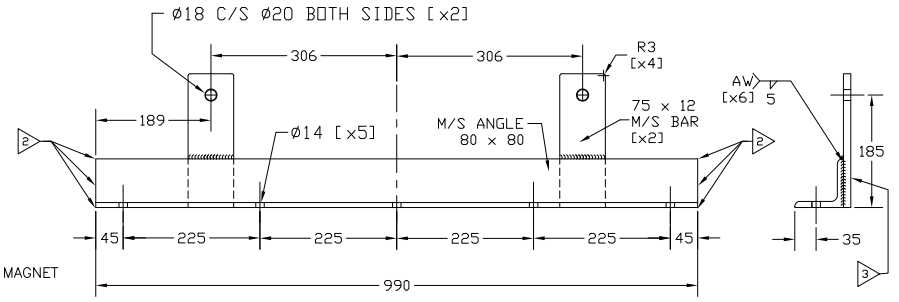
NOTE:

1. THE 5503 SHIPPING CRATE HAS A ONE PIECE TOP COVER
2. REMOVE ALL SHARP EDGES 0.5mm
3. WELD MUST NOT PROTRUDE ABOVE BAR SURFACE.
4. WRAP MAGNET WITH 0.125mm THICK PLASTIC SHEET PLACE SILICA GEL PACK NORDIC DESICCANT BAG 250-NPD-2501001141 INSIDE PLASTIC WRAP. SEAL SIDES SEAMS OF PLASTIC WRAP WITH HEAT GUN SO THAT MAGNET AND SILICA GEL PACK IS COMPLETELY SEALED INSIDE.

TOP COVER REMOVAL

1. REMOVE THE TOP COVER SECURING SCREWS. SEE ITEM (1)
2. GRIP THE TOP COVER AT THE TOP LH AND RH CORNERS
3. LIFT THE TOP COVER VERTICALLY HIGH ENOUGH TO CLEAR THE MAGNET
4. MOVE THE TOP COVER SIDEWAYS AND PLACE ON FLOOR

MAGNET MOUNTING BRACKET [2 REQ]



SHIPPING WEIGHT: 1863 kg (4099 lb)

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
PARTS LIST				

DRAWN	G.DOUGLAS	DATE	15/18/07
CHECK		DATE	
ENGINEERING		DATE	
NEXT ASSY		SYSTEM	

SOFTWARE AUTOCAD 2000

DO NOT SCALE FROM DRAWING
DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)

	INCHES	mm
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DEG.	±.5	±0.5
FINISH	63	1.6

THIRD ANGLE PROJECTION

GMW
955 Industrial Rd, San Carlos, CA 94070
Tel: (650)802-8292. Fax: (650)802-8298.

TITLE
SHIPPING CRATE ASSEMBLY
MODEL: 5503

SIZE	DRAWING NO.	REV
A1	18907-0001-0	A

SCALE 1:4 | WT kg | SHEET 1 OF 1